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Journal of Educational Research

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JOURNAL *of* EDUCATIONAL RESEARCH

Volume XI FEBRUARY, 1925 Number 2

WHEN THE SCIENTIFIC MIND MEETS POPULAR PREJUDICE

WILLIAM E. STARK
Superintendent of Schools, Stamford, Connecticut

Some fifteen years ago, when the movement for exact measurement in education was just beginning, I hailed the new idea with enthusiasm. I had had a fairly thorough scientific training in preparation for engineering so the dictum "Don't rely upon mere opinion, collect the facts" appealed to me as common sense. I adopted it as a principle.

At that time, I was working in a private institution which aimed to do pioneer work in education. In that environment, the scientific viewpoint was welcome. I had visions of a gradual transformation of school procedure in accordance with the facts. All we needed was the new knowledge to be supplied by investigation.

A year or two later, I became superintendent of public schools in a conservative town. I knew something of the difficulties encountered by school administrators, but I entered the new field secure in my grasp of the scientific principle. There would doubtless be "Missourians" even in Jersey, therefore, I must be careful not to be dogmatic in urging improvements; and I must back up my recommendations with facts.

The memory of those first years is still vivid. Every superintendent who has ever had an inspiration will know what I went through. The Jerseymen were not "from Missouri." They didn't have to be shown; in fact, they didn't want to be shown. They knew the truth already, had known it for at least forty years. The new-fangled notions of a college theorist could not

fool them. Facts? What are facts in the face of settled convictions? I discovered a new principle: A single experience or a gossip-made version of an alleged occurrence is a revelation from Heaven when it fits your prejudices, while statistics are lies, to an emphatic degree, when they conflict with what you believe.

The new superintendent ventured to try some standard tests in arithmetic. He was amazed to discover that many of the teachers—especially the older ones with a reputation for extraordinary skill in preparing their classes for examinations—were suspicious of the scheme. They were quite capable of giving their own tests. The suggestion that, with their years of experience, they did not know how to mark an examination paper in arithmetic was insulting.

The superintendent proceeded to apply his principle. He would convince the teachers by facts. The teachers were called together; each was given a copy of a pupil's examination paper and asked to mark it. Of course the results varied widely, the extremes being something like 53 and 92. Many of the teachers saw that a mark of 97 on a report card did not possess the accuracy which it pretended and that if we were to attempt to measure pupils' work, we must have a more reliable standard, but those who were surest of themselves were least convinced. They probably pitied the other teachers who had used such absurd judgment in marking the paper. At any rate they felt they were right and this new scheme was wrong.

The dissatisfaction naturally found expression and soon the boarding-house keepers and the all-wise business men, who rally to the support of the oppressed teacher when the tax rate is not involved, renewed their interest in education. The editor of the local paper was sufficiently scientific to suggest an investigation. He remarked editorially that there was some dissatisfaction with the so-called standard tests and invited citizens to write to the paper and state whether they approved of the plan. Unfortunately those to whom the truth had been revealed were not journalistically inclined so this opportunity to settle an educational problem was lost.

I have had close contact with school surveys in two cities. In both cases the work was done under the direction of men with wide experience in educational measurement. They used the best scientific methods available and collected a great array of facts. Undoubtedly their reports gave as true an evaluation of the two school systems as it was possible to make with a reasonable expenditure of time and money. The reports have been used by many students of educational administration. Apparently they have been valuable for this purpose, but they have had practically no favorable effect in the communities to which they applied.

In the first case, the surveyors gave an unexpectedly favorable rating to the school system. They said that in certain respects it was among the best systems of schools that they had seen. One would naturally have expected the school board to be elated and the citizens to be gratified, but not so. The report arrived in the midst of a campaign to force down the cost of the schools. Popular opinion regarded the rapid increase in expenditure as due to the fancy schemes of the superintendent. Before his time the local schools had been the best in the country—or in the world for that matter. For some years, a boy from the high school had always won the competitive examination for West Point. It was true that since the advent of the present superintendent there had been no competitive examinations, but that made no difference. Formerly there had been a chance every year to thrill with pride when Blanktown was announced as the winner. There had been no such opportunity in recent years, but there had been plenty of opportunity to observe approaching bankruptcy when the tax bills appeared. Obviously the schools had deteriorated, and the town was being led to destruction by a superintendent who persisted in inducing the school board to raise salaries and employ special teachers instead of sticking to the three R's.

This idea, fostered by the press and by organizations of the taxpayers, was at the head of the reception committee when the survey report came to town. If the surveyors had said that the schools were inefficient, especially if they had suggested that

money was being wasted, it is very probable that they would have gained a reputation in that town for wise judgment. As it was, they were referred to contemptuously as college theorists. The survey was condemned as an utter waste of money and dubbed "the superintendent's whitewash." "What we need," said the editor, "is a committee of business men to inspect the schools."

The report of the second survey was different. It pointed out many defects, and showed that the fundamental weakness was inadequate financial support. Here again the findings were distasteful. The surveyors recommended the appropriation of a very large sum for buildings and for enlargement of the professional staff. To many people such an expenditure was unthinkable. It was easier to believe that conditions were not really so bad. It would not do to hamper industrial and commercial development by allowing the tax rate to increase, so this report also was ignored and branded as a waste of money. Investigation of questions fully covered by the survey has been started anew by committees of business men. These studies are bound to be relatively superficial, but they may possibly lead to more acceptable conclusions.

Is our principle wrong then? Is it useless to collect the facts? What is the good of knowing the truth if it only makes the other fellow mad? It is the result that counts, is it not?

I suspect that it is not the principle but the practice which is at fault. Perhaps we have not included all the facts. Have we not left one term—popular prejudice—out of the formula? In public education any attempted solution which overlooks this term will fail. It is like those examples in pure mathematics in which we assume a perfectly elastic medium or a frictionless surface. In life, mathematics is never pure. Perfect elasticity does not exist and one can always count upon a certain amount of friction.

We may conclude, I think, not that the problem is insoluble but that it is harder than we supposed. We shall have to admit that the proportion of scientifically minded people is small whereas prejudice is almost universal. It is to be hoped, there-

fore, that the problem will be studied as a question in applied science. The scientific audience may be neglected as a factor of minor importance and prejudice will be represented by a capital letter. There are two ways to deal with friction, either to reduce it or to allow for it—both are scientific problems. Begin with the second.

We school men have profited enormously by the scientific study of education. We are learning more and more of the real facts underlying our job, but we need desperately the help of investigators in human nature, especially adult, tax-paying human nature. I cannot doubt that the complex phenomena, represented by a new school-board member, the president of a taxpayers association, or the editor of a *vox populi* newspaper, are susceptible of scientific analysis. I should think that they would furnish fascinating laboratory material for a well-trained investigator who is accustomed to explosive combinations and bad smells. He can study their behavior and tell us what to expect under certain conditions; perhaps he can discover why they behave as they do. He may be able to isolate the germ and invent an immunizing serum. In that way we shall gradually learn how to allow for the friction.

The other problem, that of reducing the friction, is educational as well as scientific. It involves changes in people, making more people more scientific. To my mind this is one of the greatest of educational problems. We have had science in the schools for many years but the vaccine has not "taken" or else only in spots. One of the most impulsive, prejudice-bound men with whom I have ever worked is an engineer who had a fine scientific training and is probably rigidly scientific in his professional work. There is no evidence that I can discover that the usual sort of scientific training develops a scientific mind toward social and civic situations.

Now you can make a scientific engineer or chemist or financier. It is being done right along. Why not a scientific citizen? No doubt it will be a harder thing to do, but I, for one, believe that it can be done when students of sufficient ability and

competent training have worked upon the problem long enough. An understanding of one's tendency to be governed by prejudice and along with it the ideal of cool-headed judgment in the light of the facts can be cultivated even in the elementary school. If such themes are made prominent throughout school and college courses, can anyone doubt that a good deal can be accomplished in giving the head a larger share in the control of human conduct?

Encouraging progress has been made by students of education in the discovery of facts and principles underlying education. By all means let the good work continue. But may we not have a division of labor? Has the time not arrived when some of our keenest thinkers and experimenters can properly leave the mental tests and coefficients of correlation to their colleagues and set to work to discover the form in which educational truth can be most readily assimilated by the public? Perhaps some of them, relieved of their present duties, may devise some experiments looking toward a new educational method, which will modify the normal human mind so that it will accept truth in preference to more palatable fiction.

SCIENTIFIC MEASUREMENT AND RELATED STUDIES IN CHINESE EDUCATION

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Upon my return to America, following a year's experience as Director of Psychological Research for the Chinese National Association for the Advancement of Education, I read an editorial in this Journal, in which the editor had dubbed me, not inappropriately, a Connecticut Yankee. The epithet is so apt that my only hope for revenge is to indicate its inadequacy. He should have referred to me as a Connecticut Yankee by the name of Marco Polo, for in spite of much protective training, my scientific expedition to China became a romantic personal voyage as well. Since I went to the Orient as a sort of representative of many colleagues, who aided me with advice and materials, I feel that, in obligation to them, I should relieve the bare recital of what was done in China by glimpses of some of those personal experiences which have made me at heart the citizen of a second country.

Before leaving the United States preliminary conferences were held with Chinese students in Columbia University, mission educators on furlough, and others who could offer helpful suggestions. A technical library was assembled, copies of all mental and physical tests and other technical forms were collected, and calculating books and machines were purchased.

The week following my arrival in China was spent at Nanking in almost continuous conference with the faculty of education of the National Southeastern University. The second week was spent in Peking conferring with a group of interested professors from Peking Teachers College, Peking National University, and Yenching University. Later, either by personal visit or correspondence, there was an exchange of views with the leading scientific students of education, both mission and Chinese, in Canton, Shanghai, Soochow, Wuchang, Tientsin, and other

places. Out of these conferences grew that part of the year's program of the Association with which I was concerned. Some of the more important decisions reached during these conferences I shall recount in some detail.

It was decided that all the research of the year be applied research rather than pure research—be practical and only incidentally theoretical. Consequently all the activities have been in the nature of projects. Researches in the strictest sense have been undertaken only when they were required for the immediate furtherance of projects. Discoveries of considerable interest have been made, but in the main they have been by-products.

It was deemed important that attention should be given to the construction, scaling, and standardization of mental and physical tests. This decision was made partly because numerous able students of Chinese education had already launched a vigorous movement in this field, and hence it provided the best immediate center for the organization of cooperative research. Also it was believed that scientific educational tests held greater practical promise for improving the efficiency of instruction than anything else that could be created in one year's time. While measurement was to receive most emphasis, other promising projects were not to be wholly neglected.

An incident will reveal the reason for this emphasis. When I went with a staff of Chinese to test the pupils in a school, the presence of a foreigner created such a sensation that it was necessary for me to hide in the office until recess or the testing was finished. On one occasion, however, I slipped out with an interpreter—a recent normal-school graduate—to see some teaching of reading of Chinese. We heard the children afar, shouting their lesson in concert. When we arrived at the door, the teacher arose and laid aside the newspaper he was reading. He dramatically raised his right arm, and at this signal, the children's voices rose nearly an octave in pitch and became ear-splitting in loudness. In the instant pauses between sentences, I heard the crying of a baby whom his scarcely older brother had brought to school. There were but few books on the desks and no pupil was looking

at one. Evidently, every pupil had memorized the pages that were being recited. This screaming in concert continued perhaps a minute, whereupon the teacher dropped his arm as a signal for the children to rest their vocal chords by dropping their voices to a lower level. Teacher and pupils were doing the best they knew how to demonstrate their skill for me. Turning to my escort I asked, "Do they teach reading like this in your school?" and in all seriousness he replied, "No, louder." My Chinese advisers held, and I think correctly, that nothing would so effectively alter this ancient method of teaching reading as the comparison of its results, by means of standard tests, with those of the modern methods used by more recently trained Chinese teachers.

In conference it was decided that tests for the elementary school should be emphasized. Those acquainted with Chinese education concur in the opinion that the secondary schools have received a disproportionate share of attention. Partly to help compensate for this improper emphasis in the past, and partly to help shift attention downward, it was decided to limit the program for secondary schools and colleges to the construction of type tests only. The progress of the work was so much more rapid than any one had anticipated that this limitation was greatly relaxed later.

It seemed advisable that most tests should be in the Chinese language and that all tests involving such language should be constructed by Chinese educators. The Chinese language is changing so rapidly that one of the greatest scholars of China confessed to me that he neither spoke nor wrote what is now the standard of perfectly pure Chinese, and that he knew of no educated man who did. Worse still, he stated that language errors increased with each additional year of schooling. Somewhat more consoling was the remark that he heard a three-year-old child correct a rhetorical error in a Mother-Goose rhyme written by a leading writer of Chinese books and that it was the common people who used the purest language. This reversal of all our habitual ideas is due to the fact that the vernacular is erupting through the crust of the old literary language. The

construction of tests in Chinese was, therefore, scarcely an appropriate undertaking for one who was not a native.

Most of the non-language tests and all tests in English, it was decided, should be constructed by mission educators. One of the pleasing features of the work was the discovery that there were more trained mission educators than were required to accomplish their part of the program.

This decision did not mean that the mission educators would have little to do. Unless one has traveled in China it is difficult to understand how extensively English is being taught and used. This spread of English in the Orient is one of the miracles of this generation. Its spread has been furthered by the fact that English in not a propaganda language for some one nation but it is the language of the friendly nation the United States, and that it is the language of trade. I have attended small Chinese gatherings where English was the medium of oral communication, because the Chinese could not understand each other in their own dialects. I had intended to learn simple Chinese in order to be able to make my way about the Chinese cities alone, but this intention was frustrated by the discovery that I must acquire a different language for Nanking and, say, Peking. Furthermore, I found that I could make my way anywhere solely equipped with English. If the riksha man did not know English, I directed him to proceed in a straight line. Meanwhile, I spoke in English to each person we passed. I rarely had to go more than four or five blocks, before I discovered a Chinaman who could understand enough English to direct my man where I wished to go. This will explain the relatively complete set of English tests that were constructed and which will later be listed in this article.

All tests in Chinese were in the national vernacular rather than in the classical language. The unanimous nature of this decision is evidence of the success of the literary revolution mentioned previously—success, at least, with the younger Chinese leaders.

To the reader, China is probably the symbol of slow change. If the Occident persists in this belief, it is destined to a rude

awakening. The ease and rapidity with which fundamental changes take place in China is phenomenal. English, just cited, is only one of a hundred illustrations that could be given. Although China is today practically feudal in its political organization, its leaders of tomorrow are extremely modern. The literary revolution, just mentioned, is probably unexampled in the history of the world. When the literary revolution started, less than ten years ago, there was a universal written or classical language, and there was a spoken language or vernacular which was quite unlike the written language. The Chinese vernaculars varied from one region to another, although the mandarin or "national" language was much more widely distributed than any other. When the pupil entered school he began the study of what was to him practically a foreign language, for he learned to read Chinese in a language which no one ever wrote or spoke. The inevitable result has been that only a highly gifted few ever acquired facility in the classical Chinese. The great majority of the school population, at the close of their educational careers, were just about as illiterate as when they began their formal education. That this was so is little wonder, for the classical Chinese writers strove to write their books in the utmost conciseness—books characterized by such short-cut allusions as, a Minerva mentality, a devotee of wave-sprung Aphrodite, or an Achilles heel. In less than ten years this has been officially swept from the public schools of China, and for it has been substituted a written mandarin language, which uses the same characters, but combines them in the way that individuals speak. Even the original characters are in danger of being superseded by a phonetic alphabet.

The program, it was decided, should be made national in scope by securing the cooperation of all recognized leaders in the technical study of Chinese education. More than thirty such individuals, together with their students, distributed among the chief population centers of China, were soon actively engaged in carrying out more than twice as many projects, and in many more projects, if each form of a test be counted as a different project.

The greatest danger that the measurement program faced was that it would enlist the support of one geographical section of China and the consequent antagonism of all other sections, because of the intense rivalries between sections which date back, in some cases, literally thousands of years. The problem was to utilize this rivalry without allowing it to get beyond control. Fortunately, these rivalries were more political and military than educational or cultural. At the very time when the armies of North China and Central China were fighting around the walls of Peking, an educational conference of delegates from these two divisions was taking place amicably within the walls of Peking. Nevertheless, there was a strong educational rivalry especially among the three cultural areas at the center of which are Peking, Nanking, and Canton. The most intense rivalry existed between Peking and Nanking, and it was here that the most delicate adjustments were required. If Nanking was asked to standardize the measurement and statistical terminology, then Peking was asked to do the same for psychological terminology, both agreeing to adopt the terminology of the other, so as to make it uniform throughout the nation. As objective methods as possible were used for distributing the year's projects among the centers, so that each would get an equal number of the most desirable ones. By maintaining as impartial an attitude as possible, by making every move openly, by communicating each proposal first to the party most likely to be offended by it, by appealing at all times to a rare devotion to the cause of Chinese education which I found common to all, and above all by having an exceptionally generous group of leaders with whom to work, I was able to avoid duplication of effort and to make the program truly national in acceptance.

The energy of the rivalry was frequently used for constructive purposes. I discovered that a group of students from the National University at Peking had fallen behind schedule, owing to the enforced absence of their leader. I made them a brief address, pointing out that Nanking would have its tests on exhibit at the summer institutes, but that theirs was in danger of not get-

ting finished in time. A few nights later I was walking in one of the parks, when I heard excited voices. Altering my direction so as to see what was going on, I came upon these students gathered around a table, drinking tea in the open air, and working overtime on their test.

It was proposed that the program should not illustrate, and thereby induce, a narrow conception of education. Consequently tests were prepared in such fields as citizenship, health, household arts, physical education, etc. In some cases tests were built in subjects where no instruction was being given, in order to bring more dramatically to public attention the need for such instruction.

Every test, it was decided, was to be carefully scrutinized from the point of view of its probable future influence upon educational emphasis. The experience of the United States has shown the tremendous influence for good or ill which standard tests exert upon educational practice. For example, long and complicated examples and all fractions were omitted from the test in arithmetic fundamentals. The presence of the former would inevitably induce the teacher to train pupils beyond the maximum essential set by modern pedagogy, and the presence of the latter would tend to fix upon China a cumbersome system from which she is now almost and fortunately free.

Each project was assigned, so far as possible, to the individual who was most interested, was best equipped to do it well, and was most likely to maintain a permanent interest in it. It was fully realized by all that this year was just the first year, and that China needs radiating centers of specialization. From the beginning, the creation of a trained leadership was put first in importance. Here my total ignorance of the language proved a blessing, for it compelled me to delegate responsibility.

At my request lest some critic be able to make the charge of undue foreign influence, the policy that all doubtful matters should be decided finally by the Chinese was established. Thus, I withheld my opinion concerning such questions as: Should test elements use the national or literary language? Should test elements read from left to right or from the top downward?

The Association decided to copyright all completed tests, arrange for their publication and distribution at a single center, keep the power to prevent price inflation, provide for the collection and tabulation of future test results, and retain a portion of the author's royalty to cover the cost of constant supervision and revision, and to foster educational research in general.

It was determined that, during the second year, the Association should organize and conduct under the supervision of its technical staff a national, cooperative self-survey, using for this purpose specially designed and almost self-administering tests. The purpose of this survey was to acquaint educators with tests, and to motivate teachers to make use of self-helps to be published by the Association. The tests were so designed as to yield automatically a reasonably fair measure of efficiency for each pupil, class, school, and school system irrespective of age or intelligence, and with and without regard to cost of instruction.

An important proposal carried out by the Association was that during the first and second semesters a class of advanced students of education should be organized in Nanking and Peking respectively to receive training in measurement and give assistance in the preparation, application, scaling, and standardization of tests. The class in Nanking was organized in the National Southeastern University. The class in Peking was a composite of students from Peking Teachers College, Peking Teachers College for Women, Yenching University, and Peking National University.[1]

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[1] The faculty directors of the Nanking class were Professors Alice L. Butler, S. Y. Chang, H. C. Chen, T. H. Cheng, J. P. Chu, S. C. Liao, C. W. Luh, H. C. Meng, C. H. McCloy, Y. C. Tu, T. L. Tsu, and T. Y. Yui. In Peking the faculty directors of the class were Professors L. C. Cha, C. Y. Chang, Y. C. Chang, C. H. Chuang, P. C. Chang, L. K. Chen, H. T. Hsüeh, T. T. Lew, Ida Lewis, P. Ling and E. L. Terman.

Similar classes and their professors in other large culture centers of China took charge of various portions of the year's program. The professors in immediate charge of these projects were as follows: E. J. Anderson, Annie E. Bradshaw, S. G. Brinkley, A. A. Bullock, H. C. Chou, Brownell Gage, J. N. Keys, H. C. E. Liu, Ralph Wells, C. H. Westbrook, and K. T. Yeung.

To the foregoing list should be added the name of W. T. Tao, general director of the Chinese National Association for the Advancement of Education, under whose able leadership the whole program was formulated and accomplished.

Another popular misconception of the China of today, in addition to the idea that it is the land of antiquity, is that it is the land of the aged. Youth does bow down to age in China, but in doing so Young China is merely manifesting its rarely beautiful courtesy as it bows Old China off the stage. This is especially true in the field of education. The older Chinese educators do not know the newer education and know they do not know it, so, with a generosity that matches the courtesy of the younger Chinese, they step aside into honorary positions, leaving the strategic work to those trained abroad in modern methods. The Chinese listed above—all young men—constitute a rather complete roll of those who are being looked to as the moulders of the present and future education of China, for these are the men who are the strategic professors in the leading teachers' colleges of China. Their students are gradually taking the places of the older Chinese, who, at present, dominate the actual administration of the public schools. Almost every important educational movement in China is being directed by young men.

An incident which occurred shortly after my arrival in Peking will illustrate my point. I spent an afternoon discussing with Dr. Huh Shih, professor of the history of philosophy and literature, National University, the question as to whether the new national language had yet become sufficiently stable for him to undertake the construction of an elaborate series of grammar tests with a view to a standardization of its grammar. Dr. Huh, who proved to be one of the most brilliant conversationalists that I met in China, is universally credited with being the Father of the Literary Revolution. This "father," like the "fathers" of many other important current movements in China, is still a young man in his "thirties."

By the plans proposed, all tests were to be scaled, so as to permit the use of data for scientific as well as practical purposes; all scaling was to be in accord with some uniform system, in order to procure comparability of scores from test to test and thus facilitate the tabulation and interpretation of results; and all direction booklets were to be modeled after a standard design, so

that teachers will find it necessary to learn just one procedure. After a detailed study and discussion of the merits and demerits of existing systems of scale construction, and after listing some twenty-five criteria for evaluating scale systems, the conferees graded these criteria for significance and then graded each scale system according to the completeness with which it satisfied each criterion. Thus the final selection was made according to the method of consensus of judgments. The result unanimously favored the T-B-G-F system. This scale system is a sort of eclectic one, representing as it does an attempt to embody as many as possible of the best features of the other leading systems, namely, grade scale, percentile scale, and age scale.

It was decided that I should prepare and distribute to the various cooperators detailed directions covering the numerous technical decisions of the conferees. The first of these bulletins gave a sample mental test and a sample examiner's guide to be published with the test. This examiner's guide illustrated how to formulate general directions for applying a test, how to prepare instructions to pupils, how to score a test and compute T, B, G, and F scores, how to interpret such scores, and how to utilize them for improving study, instruction, and supervision. The second bulletin described in great detail the steps in the process of constructing, scaling, standardizing, and publishing difficulty tests, rate tests, a battery of several tests, and product-scoring instruments such as handwriting and composition scales. The third bulletin described and illustrated the statistical process for T, B, G, and F scaling. These bulletins are too technical to be presented in this paper but anyone interested will find an elaboration of them in *How to Experiment in Education*.[2]

A determined effort was made to construct for China educational measuring instruments[3] equal or superior to those possessed by any other country. To make this possible, each person who assumed responsibility for a test pledged to do his utmost to make his test superior in at least one respect to the best of its kind previously built.

[*To be continued*]

[2] New York, Macmillan Company, 1923. 281 pp.

[3] A list of the tests will be given at the close of the article in the March number.

DIFFICULTIES IN PROBLEM SOLVING

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The majority of children have difficulty in solving arithmetic problems. This applies to the simpler one- and two-step problems as well as to more difficult ones. In a recent study made by a class of thirty-two elementary teachers, the following important causes of failure were found: (1) physical defects, (2) lack of mentality, (3) lack of skill in fundamentals, (4) inability to read which, of necessity, affects the ability to read arithmetic problems, (5) lack of general and technical vocabulary, and (6) lack of proper methods or technique for attacking problems.

Physical defects.—The pupil who has poor eyesight or defective hearing is particularly handicapped. Problems written upon the board are often not legible to the pupil with defective eyes. Frequent mistakes occur, not because the child fails to understand a given problem, but because he reads words or numbers incorrectly. It sometimes happens that neither the teacher nor the pupil recognize the difficulty, and as a result, the teacher thinks the pupil dull, and the pupil begins to doubt his ability to solve any arithmetic problem.

The child with bad hearing may miss the explanation of the very problems which bother him most. Much of the drill on oral problems is also wasted as far as he is concerned.

Nervous disorders which are either characteristic of the child or caused by poor adjustment to the school cause inferior number work. For example, a left-handed pupil who had been forced to use his right hand in one grade and allowed to follow his own inclination in another was unable to write numbers well enough to solve simple problems correctly. Some of his numbers were large and others small. The numbers 4, 5, 6, and 7 were written beginning with the last stroke normally made; he had no assurance where the number would be placed when the last

stroke was completed; and as a result, his addition and long division problems became a tangled mass of figures.

Lack of mentality.—With efficient drill practically all dull pupils can be taught to solve correctly examples involving fundamentals. Solving verbal problems is a different matter. To read the problem, to find out what is wanted, and to choose the correct process or processes, are abilities which many of the duller pupils do not possess.

Lack of skill in fundamentals.—Lack of skill in fundamentals is a constant source of error in the work of all types of pupils. A child may use correct methods in the solution of a three-step problem, but fail to place his decimal point correctly in the last step. This error may make the answer wrong by a hundred or a thousand dollars.

For example, $1.50, $15.00, $150.00, and $1,500.00 were answers given to the following problem:

> If a man bought six football tickets for $2.50 apiece, how much did he pay for them?

If the pupil's habitual reaction to 4 x 0 is 4 or 7 x 6 is 43, any problem containing these combinations is bound to be wrong. An investigation of seventh-grade pupils' ability in fundamentals conducted by Mr. O. C. France in Columbus shows that 40 percent made frequent errors in multiplying zero combinations.[1]

Not only does the lack of skill in the fundamental operations of arithmetic cause pupils to make errors in their problems, but it also leads them to attack problems by round-about or peculiar methods. A sixth-grade boy in working a problem which required that fifteen be subtracted from thirty, made thirty vertical marks on his paper, counted off fifteen, drew a line through them, and then counted the number of lines left. His answer was correct.

++++++++++++++|||||||||||||||| = 15

Several children did not know the combination 12 x 3. They solved problems by adding 3 twelve times as, 3 and 3 are 6 and

[1] France, O. C. and Stevenson, P. R. "Remedial Instruction in Arithmetic," *Educational Research Bulletin*, 2:291-97, November, 1923.

3 are 9, and 3 are 12, etc. Still another child added 12 three times instead of 3 twelve times.

Many children know how to multiply a two-digit number by another two-digit number when one of the numbers ends in zero. We have found, however, that when both numbers end in zero, some children are confused. A girl in the fifth grade had difficulty with a problem which involved the multiplying of 20 x 30. She started out by saying, "Twenty zeros by zero so there are sixty." She paused awhile, and the teacher asked, "What are you studying about?" She answered, "20 x 30, I do not know how to multiply when both numbers end in zero." Then she began to write down thirties and said, "I will just have to add ten thirties. I'll know that two times that will be the answer." She added ten thirties, multiplied by two and wrote the answer, $6.00. All this trouble would have been avoided if she could have multiplied two numbers each ending in zero.

Inability to read in general or to read arithmetic problems.—The lack of general reading ability is a serious handicap in solving arithmetic problems. The correlation between these two abilities is about .32. Pupils do not seem to think that they should read a problem carefully before beginning their work. Why should they, since they are not taught, as a rule, how to read their problems? That the ability to read problems is not greatly different from the general reading ability is shown by the high correlation of .78 between scores on a reading test in arithmetic[2] and the scores on the Buckingham Scale for Problems in Arithmetic. One way to determine whether pupils read a problem intelligently is to have them attempt to solve a problem which contains numbers not essential to the solution of the problem or problems in which the numbers to be used are not absolutely in evidence, the latter case is illustrated by the following problem:

> After John was 15 years old, he received $60 each year in equal monthly payments for spending money. How much did he receive each month?

[2] The Stevenson Problem Analysis Test, published by the Public School Publishing Company, Bloomington, Illinois.

In solving this problem, some pupils divided 60 by 4 because there are four weeks in a month. Other pupils multiplied by 15 because 15 was given in the problem. Still other pupils divided 60 by 30 because there are 30 days in a month. It is evident that these children had some hazy idea of the problem, but did not read well enough to comprehend the real situation.

Lack of general and technical vocabulary.—Very often a pupil fails to solve an arithmetic problem because one or more of the words are unfamiliar. Children do not understand as much about the meaning of words as their teachers give them credit for knowing. Not only are pupils deficient in general reading vocabulary but they are also unfamiliar with the many technical words used in arithmetics. Some of the words which are used continuously in modern arithmetics are entirely unfamiliar to the average pupil. To show what concepts pupils have of some of these words, a group of fifth-, seventh-, and eighth-grade pupils were asked to define and illustrate the word "average." The following are some of the definitions:

Average—

1. The answer to an addition problem, $4 + 6 = 10$.
2. The answer to subtraction, $1361 - 140 = 1221$.
3. The answer to multiplication, $24 \times 2 = 48$.
4. The answer to division, $42 \div 6 = 7$.
5. The answer of any problem.
6. The amount of anything like $24 + 35 = 59$.
7. The number right.
8. Is a grade or something.
9. Means your grade like, 80 or 90.
10. How much you weigh or what you are supposed to weigh.
11. About what it will be.
12. How much you have left.
13. The total cost of what you buy.
14. The cost of a new dress is the average.
15. The amount you pay for anything.
16. The amount of the bill.
17. A man got an average at the shop for working.
18. So many things.
19. $2.37 per day + $2.37 = an average of $4.74 in two days.
20. John has 25 spelling words and missed 5, his average would be 90.

Children often use a word without knowing its meaning. Occasionally, they use it correctly, but more often they do not. If

you ask a group of sixth-grade children what the word "civil" means, many of them will respond by saying "civil service" or "civil war," but when forced to tell exactly what the word "civil" means, they are unable to do so. They have connected the word with some phrase. The same is true in the case of the word "average" as indicated by the definitions, number 7, 8, 9, and 10. They have heard or read in problems such statements as the average number, the average grade, the average weight, and the average cost but have no adequate concept for the word.

From the fifth to the eighth grade, the word "area" is used continually but seldom is ever carefully explained by the teacher. The large number of meanings attributed to this word by the pupils are as follows:

Area—

1. Is a stretch of land, $7.32 + 25 = 7.57$.
2. The sum you get when you add different lands, 1 acre + 2 acres = 3 acres.
3. Length and width added together, 2 ft. long + 3 ft. wide = 3 ft. area.
4. Distance around a thing, 6 ft. long × 2 = 12; 4 ft. wide × 2 = 4; 8 ft. + 12 ft. = 20 ft.
5. Answer to subtraction problem, $3 - 2 = 1$.
6. Distance of anything, 6 miles + 4 miles + 3 miles = 13 miles.
7. How big or how tall you are.
8. Number of miles.
9. Width of a field.
10. The number of feet in a mile.
11. The number of people that live in the United States.
12. If you see how many feet you have and then divide you have the area.
13. Means population.
14. The number you get when you divide.
15. The numbers that are added.
16. Means to find the sum, 24 acres + 60 acres + 19 acres = 103 acres; how big across, and up and down.
17. The size of anything, 24 ft. + 24 ft. = 58 ft.
18. Area is 55 feet below sea level.
19. Width or length of a room.
20. Is the boundary of a country.
21. Means percent, ½ of 100 = 50%.
22. The length all the way around.
23. Part of a wireless.
24. Area is a picture drawn

A few words are used in arithmetic in a technical sense and have other meanings used elsewhere. The word "commission" is an example of this class of words. The definitions given below were received from seventh-, and eighth-grade pupils who had studied interest and commission for one or more semesters.

Commission—

1. A place where you get things cheaper.
2. The highest answer in division, addition, or subtraction, 24 — 10 = 34.
3. Is money or pay.
4. What a man earns in a week (Same as total).
5. Commission means they make the same money every week.
6. When you pay taxes.
7. Cost of something.
8. Commission of the car is not very good.
9. Out of order.
10. A thing that will not run.
11. When they let you do something.
12. Means to ask such as, May I get a drink?
13. When you ask to do something and they say "yes" it means commission.
14. What they charge to go to a show.
15. The amount you pay to go into see something.
16. Like someone go to a poor job and have a commission to go to a higher job.
17. To do something.
18. Something you are sent to do.
19. Something you pay for (commission in the army).
20. Is a thing you pot fore and after a grop of words.

This word not only has several legitimate meanings, but the pupils also confuse it with other words having different prefixes. Definitions 8, 9, and 10 present a semi-slang meaning of the word. Definitions 16, 17, and 18 represent the idea of being sent on a commission, while the nineteenth definition refers to a commission in an army. The word "permission" is defined in 11, 12, and 13 instead of "commission." In this case, they have mixed prefixes. The same is true in 14 and 15 where the word defined is evidently "admission." The last definition should read "Is a thing you put before and after a group of words." This pupil was asked to illustrate his point and to place quotation marks before and after the sentence. One wonders how these

pupils solve problems containing words to which they have attached erroneous concepts. If a child thought of "area" as the distance around a thing or "commission" as something out of order, what chance would he have in working a problem whose correct solution depended upon his definite knowledge of the meaning of the two words involved.

Lack of technique for attacking problems.—Few pupils have a technique or method which they follow when solving problems. They do not seem to know that a definite question is asked in each problem and that data are given which will help in answering the question. In order to learn something about the way pupils respond when presented with a problem, approximately fifty children were tested individually. The questions of the tester and the responses of the pupils were taken down by a stenographer. The following problem was given to these pupils and they were asked to work it and tell what they did:

When John was 13 years old he received $60.00 in equal monthly payments for spending money. How much did he receive each month? John: 11 years, grade IV-A, I.Q., 78.

John. I am going to subtract. (He put down $60.00 and said) No, I have that down the wrong way.

Observer. Why is it wrong?

John. Because I have no number but 13 to put under it.

Observer. Why can't you subtract 13 from 60?

John. It's too little. You can't do it. We never have that kind. (This boy never subtracted unless the numbers contained three or more digits.)

Another pupil, an eleven-year-old girl in the fifth grade said, $60.00 in a year, he would get $20.00." "How do you know?" the teacher inquired. The girl replied, "I go by fives because it is the quickest way. 5—10—15=20." (This girl could not solve the most simple one-step problems.)

A retarded boy in the fifth grade proceeded as follows:

Boy. He would get $40.97 because $60 - 13 = $40.97.

Observer. Why did you subtract?

Boy. It sounds better to subtract.

Observer. $40.97 a month looks like too much for $60.00 a year?

Boy. $60.00 × 13 = $180.00. That makes all the more. There is just one more way left—add.

Observer. What are you trying to find out?
Boy. What he got each month. You can divide by 13, can't you?
Observer. Yes.
Boy. Maybe it would come out better—with a smaller number (Divides by 13 and is satisfied).

Pupils often decide from the form of a problem what process to use. Several numbers mean to add. One pupil said there were too many numbers in one problem to do anything else. In this problem, "Joseph rode on a merry-go-round 12 times. Each time it cost him 3 cents. How much did he pay for all the rides?" One pupil multiplied because it said "times" in the problem. A colored girl in the sixth grade described her method of solving problems as follows: "If there are lots of numbers I adds. If there are only two numbers with lots of part (digits) I subtracts. But if there are just two numbers and one littler than the other, it is hard, I divides if they come out even, but if they don't I multiplies."

Remedial measures.—It is possible to improve pupils' ability to solve problems. I shall state briefly some of the remedial measures which have proved effective.[3]

I. Teach pupils to read problems and develop a technique for working them. When assigning the lesson have the pupils read the problem silently and teach them to pick out (1) what they are asked to find, (2) what is given to help answer the question, (3) what process or processes are to be used, and instruct them to estimate answers.

Problems which contain extra data should be so handled that the pupils will learn to pick out essential elements. The following problem illustrates this point:

The pupils in the Irving School agreed to make 675 badges for the school field meet. The day before the meet the third grade turned in 20; the fourth grade, 40; the fifth, 70; the sixth, 130; the seventh, 160; and the eighth, 200. How many badges were turned in?

Before special training, many pupils added the 675 badges promised to those turned in, for the simple reason that they were

[3] Stevenson, P. R., and others. "Remedial Arithmetic," *Educational Research Bulletin*, Vol. III, No. 13, Bureau of Educational Research, Ohio State University, Columbus, Ohio. October 15, 1924. 28 pp.

in a habit of responding to a problem containing several numbers by adding all the items.

Problems without numbers may be also employed to help the pupil to understand the processes which should be used. For example, in the following problem there are no numbers to confuse the pupil and the thought may be focused upon what should be done: If you know the height of each pupil in your class, how would you find the average height?

II. Teach the vocabulary used in problems. The pupils should state the problems in their own words, and in as many different ways as possible, while special attention should be given to technical words, such as *rate, salary, percent, dealer, commission,* etc.

III. Dramatize problems referring to measurements, e. g. pints, quarts, inches, feet, area, etc.

IV. Give a large variety of problems from life situations.

The pupils should be encouraged to make up problems dealing with their own or their parents' activities. An excellent device to increase the ease of understanding problems is to vary the language in which they are started. Problems centering around specific activities such as a field meet, a picnic, etc., arouse the interest of the pupils and serve their arithmetical purpose, too.

V. Give individual instruction. An excellent rule in arithmetic problems, as in other subjects, is to find out what the pupil needs and see that he gets it. For example, if he has vocabulary difficulties and cannot estimate answers, give him special instruction in these two phases.

A STUDY OF EFFICIENCY IN DIFFERENT TYPES OF SCHOOL ORGANIZATION

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The article which follows is based upon two detailed studies which have been made in the interest of determining the most suitable form of organization for the upper elementary grades in the Seattle public schools.

STANDARDIZED EDUCATIONAL OPINION CONCERNING INTERMEDIATE ORGANIZATION

For more than a decade now, cities have been experimenting with the various forms of organization for upper elementary grades. Industrial work, departmental teaching, duplicate schools, and junior high schools have appeared in constantly increasing proportions in the cities of the nation. It is true that the results of these innovations have not always been checked with scientific accuracy, but the whole movement has been very definitely under the scrutiny of thoughtful educators and an impressive body of educational literature has appeared as the result of this observation.

The Seattle public schools have at present three distinct types of organization and are about to introduce a fourth, the junior high school. It has seemed distinctly worth while to make a systematic inquiry among those who have been more directly in contact with the various stages of this movement in an attempt to learn what peculiar values or disadvantages are attached to the respective forms of organization now in operation. To this end, a carefully prepared questionnaire was submitted to three groups of educators: (1) university professors who have specialized in school administration or related fields, (2) superintendents of schools in cities of over 100,000 population, and (3) Seattle elementary-school principals. The questionnaire

included a description of four types of schools, of which Seattle has the first three, as follows:

1. *Academic.*—The conventional organization in which a group of approximately forty pupils are taught by one teacher in one room throughout the school day. The pupils are divided into two divisions which usually alternate in recitation and study or special occupation. The teacher is assisted by an occasional visit from special supervisors.

2. *Industrial.*—This type of organization is essentially the same as the academic in the first six grades. In the seventh and eighth grades, from sixty to seventy-five minutes daily are given to home economics for the girls and to shop work for the boys taught by special teachers in special rooms. Time for this industrial work is taken from the academic subjects.

3. *Duplicate (platoon).*—The school work of each classroom group of children from grades IV to VIII is organized into two equal parts, academic and special. The academic work, reading, arithmetic, etc., is taught by one teacher in the home room, while the special work, music, manual training, penmanship, etc., is taught by special teachers in especially equipped rooms. Two groups of children shift between the home rooms and the special rooms each quarter of the day. The school day is lengthened and more time and emphasis are given to special subjects and activities than in the academic schools. Teachers ordinarily have but a single division of pupils at a time. The division, however, usually is larger than the recitation division of the *academic* grouping and may be several times larger with certain of the special subjects, such as music or play.

4. *Junior high school.*—A plan of reorganization which groups grades VII and VIII of the elementary school and IX of the high school in one building. The work is semi-departmentalized upon the duplicate plan, promotion is by subject, the curriculum is broadened, courses are differentiated more widely, and more attention is given individual variations, guidance, and social organization.

The judges were asked to rate each of the foregoing types of school according to the degree which its form of organization improves each of ten selected factors upon which school efficiency is dependent, namely: Attendance, Progress, Achievement, Curriculum, Instruction, Administration, Supervision, Guidance, Socialization, and Low Cost. A general estimate was also called for. A set of standards for judging each of the ten factors accompanied the questionnaire.

Usable rankings were returned by thirty educational experts, twenty-two superintendents, and thirty-three principals. Judged by the number of times each type of organization was ranked

TABLE I. COMPARATIVE RANKING OF FOUR TYPES OF UPPER ELEMENTARY GRADE ORGANIZATION

Judges	Number of Times Each Type of Organization Was Ranked First			
	Academic	Industrial	Duplicate	Junior High
Experts	0	1	1	24
Superintendents	0	1	4	16
Principals	0	3	5	25
Total	0	5	10	65

first—ties excluded—in the general estimate, the rankings prevailed as shown in Table I.

This general alignment of the types of organization in order of merit gives the junior high school first place with 65 votes, the duplicate school second place with 10 votes, the industrial type third place with 5 votes, and the academic type last place with no vote.

Brevity prevents detailed consideration of the judges' opinions with reference to the ten separate factors of efficiency. They were by no means unanimous, but when the scorings are combined, the junior high school is ranked first for every factor save low cost. The duplicate (platoon) school is ranked second; the industrial school, third; and the academic school, fourth, respectively, for the same nine factors. In the case of low cost,

the foregoing order was reversed. Some of the ratings were fairly close, however, as may be seen from Table II. In this table, three merit points were allowed when a factor was assigned first place by one of the judges; two points, for second place; and one point, for third place.

TABLE II. COMPARATIVE MERIT POINTS GIVEN TO FOUR TYPES OF ORGANIZATION EXPRESSED IN PERCENT

Ten Factors	Academic	Industrial	Duplicate	Junior High	Total
1. Attendance	5	19	32	44	100
2. Progress	6	19	31	44	100
3. Achievement	7	21	35	37	100
4. Curriculum	5	31	20	44	100
5. Instruction	8	18	32	42	100
6. Administration	21	22	24	33	100
7. Supervision	14	17	29	40	100
8. Guidance	4	19	29	48	100
9. Socialization	5	19	33	43	100
10. Low cost	45	24	22	9	100
Final rating	12	21	29	38	100

The results of this inquiry are important. It is true that many, including the author, have called attention to the fact that such decisions are to a considerable extent matters of opinion which have not yet been subjected to rigid tests of measurement. On the other hand, it must be remembered that the distinct consensus of standardized opinion disclosed in the foregoing study is based upon the careful study and experience of our most thoughtful educational leaders, and, in the absence of more exact standards, may be regarded as worthy of favorable consideration until adverse evidence prevails.

Comparative Accomplishment of Academic, Industrial, and Duplicate Types of Organization

The academic, industrial, and platoon types were also compared upon the basis of school accomplishment. Six academic, six industrial, and four duplicate schools with similar general school conditions were selected for study. The achievements of 324 eighth-grade graduates from these schools in the year 1921 were compared. All graduates were chosen who had been in

their respective schools at least four years, and who had attended a Seattle high school one year. Allowance was made for difference in intelligence, and the three groups of schools were then compared upon the basis of standard tests in arithmetic and reading, on teachers' estimates, on the rate of promotion through the grades, and on success in high school.

Mental age.—In order to compare the results obtained in one group of schools with those in another it was, first of all, necessary to determine the relative native ability possessed by pupil groups in the several schools, for the number of pupils in each group was not sufficiently large to cover up the effect of

TABLE III. NUMBERS AND MENTAL FACTORS OF EIGHTH-GRADE PUPILS

Elementary Schools	Number of Pupils	Chronological Age	Average Mental Age	Accomplishment Increment*
Academic	94	14.55	14.81	.21
Duplicate	93	14.01	15.03	−.01
Industrial	137	14.21	15.16	−.14
Total	324	14.25	15.02	.00

*The accomplishment increment for any school equals the difference between the average mental age of its pupils, and 15.02, the average for the entire group.

such individual variations. Fortunately, the Illinois test for intelligence had been given to all of the eighth-grade pupils in 1921. From these results it was possible to obtain the average mentality of the pupils for each group of schools. This is shown for the three groups of schools in Table III.

It may be seen by reference to Table III, that the average mental age of the 324 pupils was 15.02 years. The 94 academic pupils averaged 14.81 years, or .21 of a year under the group average. Consequently in estimating the accomplishment of these children, an increment of .21 of a year is given to the group. In like manner, the duplicate group is penalized .01 of a year and the industrial group, .14 of a year, because of superior mental age.

Arithmetic.—The comparative efficiency of the three types of schools may be shown by the success of their respective pupils when measured in arithmetic by the Illinois test. This is indicated in Table IV.

TABLE IV. COMPARATIVE ARITHMETICAL EFFICIENCY OF THE THREE TYPES OF ELEMENTARY SCHOOLS

Elementary Schools	Number of Pupils	Achievement Age	Mentality Increment	Accomplishment Age	Accomplishment Credit
Academic	94	14.02	.21	14.23	−.33
Duplicate	93	15.31	−.01	15.30	.74
Industrial	137	14.42	−.14	14.28	−.28
Total	324	14.56	.00	14.56	.00

In Table IV, the third column gives the test record, the fourth column indicates the allowance to be made for high or low mentality, the fifth column shows the weighted score, and the final column indicates the amount of plus or minus credit due the particular school for its own comparative efficiency in arithmetical instruction. Making adjustments for the mentality increments, the actual arithmetical accomplishments of the three types of schools are academic, 14.23; duplicate, 15.30; and industrial, 14.28. Based upon the entire group average of 14.56 years, the academic group has a –.33 of a year accomplishment credit, the duplicate group has a .74 of a year accomplishment credit, and the industrial group has a –.28 of a year credit. This places the duplicate group distinctly in the lead in arithmetical accomplishment with the other two types approximately equal.

Reading.—The schools were measured on the basis of results in the Illinois test for reading and comprehension in a manner similar to that described for arithmetic. The results are given in Table V.

The third column gives the test record, the fourth column indicates the allowance to be made for high or low mentality, the fifth column shows the weighted score, and the final column indicates the amount of plus or minus credit due the particular

school for its own efficiency in reading instruction as compared with the other elementary schools. It may be seen from Table V that the average accomplishment age in reading comprehension of the 94 pupils in the academic type of schools was 15.62 years, which is .30 of a year below the 15.92 year average of the entire group of 324 pupils. The 93 pupils in the duplicate school scored an average reading record of 16.39 years which is .47 of a year above the group average. The 137 industrial pupils scored an average reading record of 15.81 years which is .11 of a year below the group average. Here again, as with arithmetical accomplishment, the duplicate type of school is far in the lead in the results of its instruction in reading as based

TABLE V. COMPARATIVE READING EFFICIENCY OF THE THREE TYPES OF ELEMENTARY SCHOOLS

Elementary Schools	Number of Pupils	Achievement Age	Mentality Increment	Accomplishment Age	Accomplishment Credit
Academic	94	15.41	.21	15.62	−.30
Duplicate	93	16.40	−.01	16.39	.47
Industrial	137	15.95	−.14	15.81	−.11
Total	324	15.92	.00	15.92	.00

upon the reading comprehension test. It leads the industrial type by .58 of a year, while the industrial type in turn leads the academic type by .19 of a year.

Rate of progress.—The three types of schools were also measured by the average length of time required for pupils to complete the eight grades. The average time of the 324 pupils was 7.9 years. By the same method of comparison used above, it was discovered that the academic schools' comparative accomplishment in school progress was —.01 of a year, the duplicate schools' comparative accomplishment was plus .09 of a year, and the industrial schools' comparative accomplishment was —.05 of a year. Again, the duplicate type of school leads. It gained approximately four times as much in eight years as the industrial schools, and two times as much as the academic schools.

School marks.—Each pupil was given a final elementary-school mark of P, F, G, or E to indicate his general standing. It was possible to reduce these marks to an age basis by assigning to each mark the average mental age of all pupils receiving it. On this basis, and by the same method described above, the three types of schools were compared according to final marks. Here, again, the duplicate type of schools was ahead with a

TABLE VI. COMPARATIVE PUPIL ACCOMPLISHMENT

Schools	Reading Achievement	Arithmetic Achievement	Teachers' Estimates	Gain in Promotion
Duplicate	16.39	15.30	15.16	.19
Industrial	15.81	14.28	14.85	.05
Academic	15.62	14.23	15.13	.09

final credit of .21. The academic schools have a credit of .06, and the industrial schools a negative credit of —.18.

TABLE VII. COMPARATIVE EFFICIENCY OF SEATTLE TYPE OF ELEMENTARY SCHOOLS

	Elementary Schools*		
	Academic	Duplicate	Industrial
Mental age	14.81	15.03	15.16
Mentality increment	.21	−.01	−.14
Arithmetic accomplishment credit	−.33	.74	−.28
Reading accomplishment credit	−.30	.47	−.11
Progress accomplishment credit	−.01	.09	−.05
Final elementary mark credit	.06	.21	−.18
Total credit	−.58	1.51	−.62

*All figures are given in years upon an average age accomplishment basis.

Thus far the results of the records which are available for measuring elementary-school efficiency indicate a uniform superiority on the part of the duplicate schools. Table VI presents a summary of this on the basis of school achievement in age levels.

Finally, we may summarize the situation upon the basis of comparative accomplishment credits. This is done in Table VII which exhibits in distinct fashion the relative merits of the three types of schools in each of the four tests of efficiency.

Space forbids more than mention of a number of studies made to determine the success of the three groups of pupils in their first year's high-school work. Studies were made as to the amount of work taken, the difficulty of the subjects selected, and the kind of marks received. We may generalize roughly, with reference to these high-school studies, by saying that it apparently makes little difference in high school as to what type of elementary school precedes it. High-school success in the main, seems to depend more upon general intelligence than upon any other noted factor.

MENTAL ABILITY OF FRESHMAN HIGH-SCHOOL PUPILS

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The rapid increase in high-school enrollment within recent years has brought with it new problems of adjusting the work of the high school to the needs of the pupils. The increase has been unusually great during the past three or four years. Table I shows the number of pupils in each grade for each 100 pupils in the first grade during the years 1912-13 and 1922-23. For each 100 first-grade pupils in 1912-13 there were 21 first-year high-school pupils and 6 senior high-school pupils. In 1922-23 the proportions had increased to 46 first-year pupils and 11 senior

TABLE I. COMPARISON OF MEMBERSHIP BY GRADES IN CHICAGO SCHOOLS

GRADE	1912–13		1922–23		GAIN
	Total Membership	Percent of First Grade	Total Membership	Percent of First Grade	
I	40,970	100	50,641	100	0
II	31,517	77	41,048	81	4
III	32,515	79	39,617	78	−1
IV	30,033	73	37,437	74	1
V	29,492	72	36,037	71	−1
VI	25,313	62	33,474	66	4
VII	20,331	50	30,314	60	10
VIII	16,713	41	27,121	54	13
IX	8,534	21	23,159	46	25
X	4,865	12	14,426	28	16
XI	2,815	7	7,317	14	7
XII	2,403	6	5,423	11	5

pupils. In 1913 there were 46 pupils in the high school for each 100 pupils in the first grade and in 1923 there were 99 pupils in the high school for each 100 in the first grade.

At the present time about 90 percent of all pupils who graduate from the elementary schools of Chicago enter the high schools. In 1912-13 about 7 percent of the pupils enrolled in the public

schools were in the high school, while in 1922-23 the proportion had increased to 14 percent. During this ten-year period the enrollment in the ninth grade increased 171 percent and the enrollment in all grades above the elementary school increased 174 percent, while the population of the city increased only 24 percent. These figures show that there is a general re-awakened interest in education and that the high schools face a serious problem in taking care of the increased enrollment.

A large number of school administrators and high-school teachers believe that the general level of mental ability has been lowered by this rapid influx of high-school pupils. If this be true the small proportion of elementary-school graduates who formerly attended high school must have been those of higher mental ability. Now since practically all pupils enter the high school, we are getting not only those of high mental ability but those of low mental ability as well.

Instruction in the high school has become more difficult because of this wider variation among the pupils. Teachers have recognized differences in the mental ability and interests of individual pupils, and efforts have been made to provide for their needs on the basis of these differences. Electives have been provided, because we recognized that all pupils will not derive equal benefit from the same course and that all pupils are not interested in the same subjects. In practically all of the high schools technical and commercial courses have been introduced for the benefit of those pupils who wish training which will assist them in securing industrial or commercial positions. Two-year vocational courses have been provided for pupils who wish to specialize in vocational work and who cannot take the full four-year course. These provisions have not adequately taken care of individual differences, however, for a large proportion of pupils fail in their high-school work.

At the end of the first semester in January, 1923, the average percent of failure in the subjects of English, mathematics, science, history, Latin, and modern languages was 16 percent for first-year pupils, about 14 percent for second-year pupils, about 10

percent for third-year pupils, and about 5 percent for fourth-year pupils. The average percent of failures in each subject, all classes combined, is as follows: history, 9 percent; English, 12 percent; science, 12 percent; modern languages, 15 percent; mathematics, 17 percent; and Latin, 18 percent. If we can determine what level of mental ability is necessary for success in the various school subjects and also the amount of mental ability which is required for success in the various vocations, it should be an easy matter to guide these pupils into the high-school courses in which they can succeed and which will be of most value to them. In order to carry this program forward an objective measure of mental ability is necessary.

As a means of determining the general mental level, as well as individual and group variation, the Otis Self-Administering Test of Mental Ability, Intermediate Examination, Form A, was given to the freshmen who entered the Chicago high schools in September, 1923. The scores of this test were first converted into Binet mental-age equivalents. B-scores were computed which made possible the determination of the school grades in which the pupils' mental ability would place them.[1]

The distribution of chronological ages is shown in Table II, while the distribution of mental ages is given in Table III. The median chronological age is 14 years 5 months; the median mental age, 14 years 4 months. Terman's table[2] gives 14 years 6 months as the standard mental age for beginning the ninth grade, which is equivalent to the B-score 9.0. On this basis the pupils who took the test are two months below normal mental ability for the grade, and the mental age is one month below the chronological age. The range of mental ages is three and a half years greater than the range of chronological ages. The B-scores

[1] B-Score represents the grade status of the pupil in grades and months. According to Terman the standard mental age for beginning ninth grade is 14-6, therefore a mental age of 14-6 is equivalent to a B-Score of 9.0, or the first month of the ninth grade. Since the school year is divided into ten months the B-Score may be represented as a grade and tenths of a grade.

[2] The standards according to Terman's table may be slightly high for the present time because the average age of pupils entering the high school has decreased within recent years. The average age of ninth-grade pupils at the time of their first enrollment was 14-11 in 1912-13 and 14-8 in 1922-23.

show that there are 26 pupils of second-grade ability at the lower extreme and 16 pupils of freshman-college ability at the upper extreme. There are 3,123 pupils who are capable of doing work equivalent to tenth grade or above and 4,778 pupils whose capacity is seventh grade or below. This wide range in mental ability indicates the tremendous task which the high schools have in ad-

TABLE II. DISTRIBUTION ON THE BASIS OF CHRONOLOGICAL AGE FOR IX-B PUPILS, SEPTEMBER, 1923

Age	Chronological Age
	Number of Pupils
18–6 up	49
18–0 to 18–5	26
17–6 to 17–11	56
17–0 to 17–5	82
16–6 to 16–11	187
16–0 to 16–5	411
15–6 to 15–11	908
15–0 to 15–5	1,547
14–6 to 14–11	2,400
14–0 to 14–5	3,010
13–6 to 13–11	2,385
13–0 to 13–5	1,131
12–6 to 12–11	355
12–0 to 12–5	85
11–6 to 11–11	18
11–0 to 11–5	2
Total	12,652
Median Age	14–5

justing the program to meet the needs of pupils who show such differences in capacity. A single score on a group test, however, should not be taken as the sole criterion in rating pupils, because a group test may involve accidental errors. But, regardless of these errors, the test does seem to measure fairly accurately the ability of pupils to do the work now presented in high schools.

Table IV shows the relation between chronological age and mental age. The median mental age has been computed for each chronological-age group and the median chronological age has been computed for each mental-age group. It will be noted that as the chronological age becomes smaller the median mental age

becomes larger, and to a lesser degree as the mental age becomes smaller the median chronological age becomes greater. The pupils, therefore, who are underage for their grades have greater ability than the pupils who are overage. This reflects a tendency to promote on the basis of age rather than ability.

A comparison of the twenty-six high schools on the basis of the general mental level and variability is given in Table V. At

TABLE III. DISTRIBUTION ON THE BASIS OF MENTAL AGES AND B-SCORES FOR IX-B PUPILS, SEPTEMBER, 1923

Mental Age	No. of Pupils	Range of B-Scores
18–6 up	16	13.0 up
18–0 to 18–5	148	12.5 to 12.9
17–6 to 17–11	265	12.0 to 12.4
17–0 to 17–5	410	11.5 to 11.9
16–6 to 16–11	844	11.0 to 11.4
16–0 to 16–5	680	10.5 to 10.9
15–6 to 15–11	760	10.0 to 10.4
15–0 to 15–5	1,286	9.5 to 9.9
14–6 to 14–11	1,402	9.0 to 9.4
14–0 to 14–5	1,250	8.5 to 8.9
13–6 to 13–11	813	8.0 to 8.4
13–0 to 13–5	1,074	7.5 to 7.9
12–6 to 12–11	1,190	7.0 to 7.4
12–0 to 12–5	918	6.5 to 6.9
11–6 to 11–11	539	6.0 to 6.4
11–0 to 11–5	440	5.5 to 5.9
10–6 to 10–11	291	5.0 to 5.4
10–0 to 10–5	174	4.5 to 4.9
9–6 to 9–11	61	4.0 to 4.4
9–0 to 9–5	39	3.5 to 3.9
8–6 to 8–11	26	3.0 to 3.4
8–0 to 8–5	17	2.5 to 2.9
7–6 to 7–11	9	2.0 to 2.4
Total	12,652	
Median Age	14–4	

one end of the scale is a high school with a median mental age of 12 years 3 months and at the other is a school with a median mental age of 15 years 5 months. This shows a difference in mental ability of 3 years 2 months, or more than three school grades. The pupils in the school showing the lowest ability on the average are capable of doing work which is equivalent to that of a normal high-sixth grade. The pupils in the school showing the

highest mental level are capable of doing work which would be normal for the high-ninth grade. The 75-percentile in school A is just equal to the 25-percentile in school Y. The inter-quartile range varies from 2 years for school E to 3 years 8 months for school C. The average for all pupils is 2 years 9 months.

TABLE IV. COMPARISON OF CHRONOLOGICAL AGE AND MENTAL AGE

Mental Age	Chronological age								Total	Median Chronological Age
	11 to 11–11	12 to 12–11	13 to 13–11	14 to 14–11	15 to 15–11	16 to 16–11	17 to 17–11	18 to 18–11		
18–11 to 18.	1	15	81	49	14	3	1		164	13-0
17–11 to 17.	5	51	268	274	58	16	2	1	675	14-1
16–11 to 16.	4	85	533	640	220	29	9	4	1,524	14-2
15–11 to 15.	2	83	646	917	315	71	8	4	2,046	14-4
14–11 to 14.	6	86	768	1,193	482	95	14	8	2,652	14-5
13–11 to 13.	1	50	470	839	417	90	12	8	1,887	14-6
12–11 to 12.		46	496	903	508	106	30	19	2,108	14-7
11–11 to 11.		17	167	398	267	92	27	11	979	14-9
10–11 to 10.		6	75	154	129	67	25	9	465	15-0
9–11 to 9.		1	11	29	30	17	7	5	100	15-4
8–11 to 8.			1	11	13	10	3	5	43	15-9
7–11 to 7.	1			3	2	2		1	9	15-3
Total....	20	440	3,516	5,410	2,455	598	138	75	12,652	
Median Mental Age.	16-0	15-2	14-8	14-4	13-8	13-1	12-3	12-4	14-4	

Table VI compares not only the median ability but also the variability of the pupils grouped according to courses. The difference between the 25-percentile and the 75-percentile represents the range of the middle 50 percent of the pupils. This range is shown in Figure 1. There is considerable overlapping in the groups, yet the differences in general level of mental ability are clearly evident. The difference between the two-year and four-year pupils is marked. The pupils of higher mental ability, as measured by this test, select the more difficult courses in school, while the pupils of lower mental ability select the technical and commercial courses. The pupils in the Latin course show the highest mental ability, yet Latin causes the largest proportion of failures.

Summary

1. Enrollment in Chicago high schools has increased 171 percent during the last ten years, while the population of the city has increased only 24 percent. The relation of the number of

TABLE V. COMPARISON OF THE MENTAL ABILITY OF BEGINNING FRESHMEN PUPILS IN THE TWENTY-SIX HIGH SCHOOLS SEPTEMBER, 1923

School	Number of Pupils	Median Chronological Age	Mental Age			Interquartile Range
			25-Percentile	Median	75-Percentile	
A	304	16-0	10-11	12-3	13-8	2-9
B	286	14-5	11-11	13-1	14-11	3-0
C	175	14-11	12-0	13-3	15-8	3-8
D	254	14-2	12-2	13-5	15-8	3-6
E	355	14-4	12-1	13-5	14-10	2-9
F	546	14-3	12-6	13-10	15-4	2-10
G	1,005	14-3	12-7	13-11	15-3	2-8
H	756	14-6	12-8	14-2	15-4	2-8
I	311	14-5	12-8	14-2	15-6	2-10
J	483	14-7	12-9	14-3	15-6	2-9
K	707	14-3	12-10	14-3	15-6	2-8
L	365	14-4	12-10	14-3	15-5	2-7
M	146	14-5	12-10	14-3	15-4	2-6
N	568	14-8	12-6	14-4	15-4	2-10
O	990	14-3	12-11	14-4	15-7	2-8
P	1,061	14-5	12-8	14-4	15-4	2-8
Q	416	14-5	12-11	14-5	15-8	2-8
R	620	14-6	13-0	14-6	15-9	2-9
S	640	14-5	13-0	14-6	15-7	2-7
T	287	14-4	13-1	14-8	15-8	2-7
U	895	14-3	13-3	14-8	15-10	2-7
V	115	14-0	13-7	14-10	16-0	2-5
W	34	14-4	13-2	15-0	16-1	2-11
X	603	14-4	13-11	15-1	16-5	2-6
Y	690	14-5	13-8	15-1	16-6	2-10
Z	40	14-9	14-9	15-5	16-9	2-0
Total	12,652	14-5	12-9	14-4	15-6	2-9

pupils in high school to the number in the first grade has increased 53 percent.

2. Individual differences have been recognized and efforts have been made to provide for these differences through electives, technical and commercial courses, and two-year vocational courses. The proportion of failures in high school indicates that

these efforts have not been entirely successful, for the proportion varies from 16 percent for first-year pupils to 5 percent for fourth-year pupils and from 9 percent in history to 18 percent in Latin.

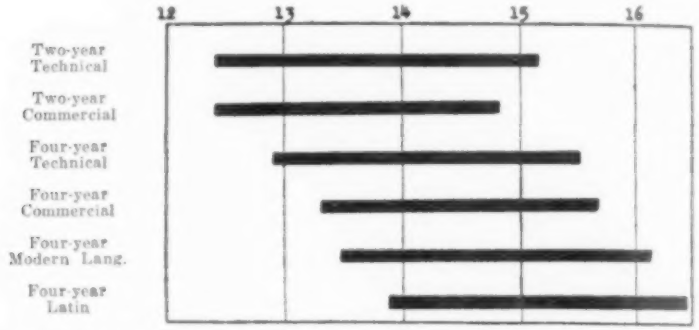

FIGURE 1. RANGE OF THE MIDDLE 50 PERCENT OF THE PUPILS SELECTING THE VARIOUS COURSES

TABLE VI. COMPARISON OF PUPILS SELECTING THE VARIOUS COURSES IN HIGH SCHOOL, SEPTEMBER, 1923

Course	Number of Pupils	25-Percentile	Median	75-Percentile
Two-year Technical	585	12–4	13–5	15–1
Two-year Commercial	1,007	12–4	13–7	14–10
Four-year Technical	1,394	12–10	14–5	15–6
Four-year Commercial	311	13–3	14–9	15–8
Four-year Modern Language	403	13–5	14–11	16–2
Four-year Latin	625	13–10	15–1	16–6

3. The mental ability of the beginning high-school pupils in Chicago ranges from the equivalent of second-grade ability to that of college freshmen. The average is two months below Terman's standard.

4. On the whole the pupils who are over-age chronologically are under-age mentally and the pupils who are under-age chronologically are over-age mentally.

5. The difference in general mental level of the pupils in the various high schools ranges from ability to do high-sixth-grade

work to ability to do high-ninth-grade work. The 75-percentile of the poorest school is equal to the 25-percentile of the next to the best school.

6. The high-school courses seem to be influential in selecting pupils on the basis of ability. The differences between the median mental age of the two-year technical pupils and the four-year Latin pupils is one year and eight months. Although the Latin pupils have the highest mental rating, they also show the highest percentage of failures.

Application of Results

The results of this test have been used for a wide variety of purposes in the different high schools. Some schools made absolutely no use of the results and others used them for classification, for vocational and educational guidance, for studying teachers' marks, and for individual diagnosis and treatment. The most common use is that of grouping pupils into more homogeneous groups. Four of the high schools used the test for this purpose and it is the almost unanimous testimony of the teachers that it has been a success. Some reasons given are: (1) When work is assigned to the class, the pupils finish at nearly the same time if they have been properly grouped; without grouping, the brighter pupils finish before the duller pupils have hardly begun. (2) Group instruction is greatly facilitated, because the requirements of all members of the class are more nearly equal. The superiority of the brighter pupils is not so evident, neither is the inferiority of the duller pupils so noticeable. (3) There is greater incentive to effort when pupils are competing with their peers.

At least one of the high schools has used the results of mental tests for other phases of educational and vocational guidance. The pupils are advised to take courses in which they would be most likely to succeed and are also advised within wide limits as to the kind of occupation in which they would be most likely to meet with success. Pupils of inferior ability may be limited to less than the normal number of subjects, while pupils of superior ability are allowed to take additional studies.

In one school the teachers were not apprised of the results of the test, for the principal expects to study the relation between the scores and the teachers' marks at the end of the semester.

One of the most valuable uses which has been made of these test results is that teachers, because they realize the great differences between individuals, are adapting the instruction to the needs of the pupils. The scores enable them to distinguish more clearly between the pupil who cannot and the pupil who will not. Too long these pupils have been treated in the same way, although their needs were entirely different. Concrete evidence of these individual differences has led teachers to study more carefully the capacity and interests of the pupils, and there has been considerable discussion as to what provisions should be made for the pupils of limited ability. A resolution has been proposed by the teachers of one high school recommending "the extension of the curriculum by the addition of special short unit courses adapted to the needs of these pupils." These courses would be designed to give the following results: (1) to establish self-confidence in the pupils, and give some feeling of the joy in achievement; (2) better to fit them to secure and hold jobs; (3) to give a broader outlook on life and better to prepare them to take their places in the social group; and (4) to help them to make the most of leisure time.

A group of elementary-school principals has expressed the opinion that the high schools should be furnished with data in the form of test scores, school marks, and judgment of teachers, which show the varying abilities of entering pupils. One means which is proposed for providing for these individual differences, both in elementary and high school, is the organization of the school on the basis of ability.

These in brief are some of the purposes for which the tests of mental ability are being used in the Chicago high schools. The test which was given in September is the first which has been used in a general way. Several schools had never given a test of this kind to their pupils. Nevertheless, there seems to be a wholesome interest in the use of test data which help the teachers to appreciate the needs of their pupils and to do their work better than they would without this objective means of measuring the capacity to learn.

TEACHERS' MARKS AND INTELLIGENCE

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For the purpose of this study the writer selected the report cards of the pupils in the Garfield Junior High School at Fond du Lac, Wisconsin who had been given the Otis, Form A, Intelligence Test the preceding spring. The total enrollment was well over the five hundred mark, but a number were absent the day the test had been given, while others had moved into the district during the summer. Hence, there were but 425 pupils whose index of brightness was known. The junior high school includes the seventh, eighth, and ninth grades, and the group of pupils, here considered, were distributed about equally among the three grades.

To find the standard deviation from which to compute the coefficient of correlation, it is necessary that a uniform basis of marking be used in the two functions. Hence, the index of brightness of each pupil was reduced to a percentage basis, that it might conform to the teachers' marks, and was then copied on the report cards and the cards arranged according to the rank of the index of brightness, from the highest to the lowest. With each pupil's index of brightness was tabulated his second-semester record which included his marks in English, mathematics, and history and the sciences, in addition to the average of all his marks. This average included, in addition to the three subjects mentioned above, hygiene-sanitation in the seventh grade, general science and one elective subject in the eighth grade, and two elective subjects in the ninth grade.

The median mark was obtained for the index of brightness (on percentage scale) and for each subject. These were: index of brightness, 74.7; English, 81.7; mathematics, 82.6; history, 86.1; and the average of all marks, 85.1 percent.

Mention should be made of the fact that the scholastic marks of the school as a whole, for the first semester, distributed them-

selves roughly according to the probability curve, 4 percent falling between 94-100; 27 percent, between 88-93; 34 percent, between 81-87; 25 percent, between 75-80; and 7 percent, below 75 percent which is the passing mark. At the beginning of the second semester, however, sixty-eight of the 425 pupils were promoted from the sixth grade. These pupils had been in that grade but one semester and were the "pick" of the grade. This was the beginning of semi-annual promotion to the junior high schools at Fond du Lac. In consequence of this the curve representing the distribution of marks for the second semester showed a disproportionate number of high marks. There were 4 percent between 94-100, 34 percent between 88-93, 28 percent between 81-87, 26 percent between 75-80, and 8 percent below 75.

It should be noted, also, that the pupils were grouped in homogeneous groups according to their indexes of brightness. There were from five to seven sections of each of the required subjects and one of these sections consisted of those of highest index of brightness which we shall call Section A, another of lowest index of brightness which we shall call Section C, while the B sections consisted of pupils between these extremes. The pupils themselves were not informed of the basis of classification and, although the teachers knew the basis of classification, no teacher knew the index of brightness of any pupil. Teachers were urged throughout the year to suit the work to the capacities of their particular sections. The three sections were given the same minimum essentials, while Sections A and B were given more refinements of the subject-matter and did more collateral reading, etc.

The 425 pupils were divided into five equal groups of eighty-five each, Group I comprising pupils 1-85, those having the highest index of brightness; Group II, pupils 86-170, comprising pupils of next highest index of brightness; Group III, pupils 171-255; Group IV, pupils 256-340; and Group V, pupils 341-425, those having the lowest index of brightness.

The following determinations were made for each subject:

A. 1. The number of honor pupils, those having a mark of 90 percent or above, in each of the five groups.

2. The number above the median in each group.
3. The number below the median in each group.
4. The number of failures; those below 75 percent, in each group.

B. 1. The percentage of honor pupils in each group.
2. The percentage of pupils above the median in each group.
3. The percentage below the median in each group.
4. The percentage of failures in each group.

C. 1. The distribution, in percent, of the pupils on the honor roll among the five groups.
2. The distribution, in percent, of the pupils above the median among the five groups.
3. The distribution, in percent, of the pupils below the median among the five groups.
4. The distribution, in percent, of the failures among the five groups.

TABLE I. DISTRIBUTION OF MARKS IN ENGLISH AMONG THE FIVE GROUPS EXPRESSED IN PERCENT

	Groups				
	I	II	III	IV	V
Above 90	31.7	24.7	21.1	16.4	3.5
Above median	70.5	68.2	54.1	49.0	23.5
Below median	29.5	31.8	45.9	51.0	76.5
Failing	2.3	5.8	7.0	9.4	17.6

Median 81.7

Results

We may now ask whether or not there are more honor pupils to be found in Group I than in Group II, and more in Group II than in Group III, and whether we shall find the lowest number of honor pupils in Group V. Likewise, are there more pupils above the median to be found in Groups I and II than in IV and V? And how do the number of failures in Group I and Group V compare? Between which subject and intelligence is there the closest relation and which subject is least related to intelligence? These questions can be answered by a study of the Tables I and II.

It is interesting to note, in Table I, that 70.5 percent of the pupils in English in Group I were above the median for the 425 pupils, while 31.7 percent made marks of 90 or above and only 2.3 percent failed to pass. In Group II, 68.2 percent were

above the median and 24.7 percent on the honor roll with only 5.8 percent failing. Those above the median and above 90 percent steadily decrease as one goes from Group I to Group V and the percent of failures steadily increases, until in Group V there are only 23.5 percent above the median and only 3.5 percent above 90, while 17.6 percent in this group failed to pass.

Table II indicates that 32.5 percent of all the honor pupils were in Group I with only 3.6 percent in Group V, that 26.5 percent of the pupils above the median were in Group I and only 8.9 percent in the lowest group with a steadily decreasing percentage in the three intervening groups. We also note that only 5.5 percent of the failures occurred in Group I, while 41.7 per-

TABLE II. DISTRIBUTION OF THE STANDINGS IN ENGLISH MADE BY THE PUPILS IN THE FIVE GROUPS EXPRESSED IN PERCENTS

	Groups					Total
	I	II	III	IV	V	
Above 90	32.5	25.3	21.7	16.8	3.6	99.9
Above median	26.5	25.6	20.3	18.6	8.9	99.9
Below median	12.5	13.4	19.6	21.7	32.7	100.0
Failing	5.5	13.9	16.6	22.2	41.7	99.9

cent are to be found in Group V. Thus, there were nine times as many honor pupils in Group I as in Group V and three times as many above the median in Group I as in Group V. Likewise, there were seven and a half times as many failures in Group V as in Group I.

The coefficient of correlation between the English ratings and the indexes of brightness was found to be 0.35.

Table III indicates that the relation between intelligence and marks in mathematics is a little less than that between English marks and intelligence. The percent of each group on the honor roll decreases from 37.6 in Group I to 9.4 in Group V; the percentage above the median from 62.4 in Group I to 31.7 in Group V and the percentage of failures increases from 2.3 in Group I to 14.1 in Group V. Or as summarized in Table IV, the total number of honor pupils decreases from 30.7 percent

in Group I to 7.7 percent in Group V; those above the median from 24 percent in Group I to 12.3 percent in Group V, and the failures increase from 6.6 percent in Group I to 43.3 percent in Group V. In other words, there were approximately four times as many honor pupils in Group I as in Group V, while there were more than six and one-half times as many failures in Group V as in Group I. The coefficient of correlation is 0.34.

TABLE III. DISTRIBUTION OF MARKS IN MATHEMATICS AMONG THE FIVE GROUPS EXPRESSED IN PERCENTS

	Groups				
	I	II	III	IV	V
Above 90	37.6	29.4	23.5	22.3	9.4
Above median	62.4	61.2	56.4	47.0	31.7
Below median	37.6	38.8	43.6	53.0	68.3
Failing	2.3	4.7	5.8	7.0	14.1

Median 82.6

TABLE IV. DISTRIBUTION OF THE STANDINGS IN MATHEMATICS MADE BY THE PUPILS IN THE FIVE GROUPS EXPRESSED IN PERCENTS

	Groups					Total
	I	II	III	IV	V	
Above 90	30.7	24.0	19.2	18.2	7.7	99.8
Above median	24.0	23.6	21.8	18.1	12.3	99.8
Below median	15.6	16.1	18.0	21.9	28.2	99.8
Failing	6.6	13.3	16.6	20.0	43.3	99.8

Tables V and VI portray an even closer relation between teachers' marks and intelligence. We find here six and one-half times as many pupils on the honor roll in Group I as in Group V, for 34.8 percent are found in the first group with only 5.3 percent in the lowest. There are likewise more than four times as many marks above the median in Group I as in Group V, for the percentage decreases from 31.4 to 7.8. As to failures, 68.3 percent are found in the lowest group, while the group of highest intelligence is conspicuous by the absence of failures. The coefficient of correlation is 0.47.

TABLE V. DISTRIBUTION OF MARKS IN HISTORY AMONG THE FIVE GROUPS EXPRESSED IN PERCENTS

	Groups				
	I	II	III	IV	V
Above 90	47.0	36.5	24.7	20.0	7.1
Above median	70.6	54.1	43.5	38.8	17.6
Below median	29.4	45.9	56.5	61.2	82.4
Failing	0.0	2.3	2.3	2.3	15.3

Median 86.1

TABLE VI. DISTRIBUTION OF THE STANDINGS IN HISTORY MADE BY THE PUPILS IN THE FIVE GROUPS EXPRESSED IN PERCENTS

	Groups					Total
	I	II	III	IV	V	
Above 90	34.8	27.0	18.2	14.7	5.3	100.0
Above median	31.4	24.0	19.3	17.3	7.8	99.8
Below median	10.7	16.6	20.5	22.2	29.9	99.9
Failing	0.0	10.5	10.5	10.5	68.3	99.8

TABLE VII. DISTRIBUTION OF AVERAGE OF ALL MARKS AMONG THE FIVE GROUPS EXPRESSED IN PERCENTS

	Groups				
	I	II	III	IV	V
Above 90	27.0	15.1	11.8	7.0	1.2
Above median	76.4	63.5	56.4	40.0	16.4
Below median	23.6	36.5	43.6	61.0	83.6
Failing	0.0	7.0	8.2	8.2	23.6

Median 85.1

TABLE VIII. DISTRIBUTION OF AVERAGE STANDINGS AMONG THE FIVE GROUPS EXPRESSED IN PERCENT

	Groups					Total
	I	II	III	IV	V	
Above 90	43.4	24.5	19.0	11.3	1.8	100.0
Above median	30.2	25.1	22.3	15.8	6.5	99.9
Below median	9.5	14.7	17.6	24.2	33.8	99.8
Failing	0.0	15.0	17.5	17.5	50.0	100.0

Tables VII and VIII give, perhaps, the most accurate conception of relations between marks and intelligence. These marks are, of course, based not only on required subjects but on the electives which pupils choose, presumably because they are most interested in them. It is here that one would expect to find native intelligence most closely related to marks. Here we find 43.4 percent of the honor roll in Group I as against only 1.8 percent in Group V. There are, then, more than twenty-four times as many honor pupils in Group I as in Group V. Likewise, there are nearly five times as many pupils above the median in Group I as in Group V, the percent decreasing from 30.2 to 6.5. Not a single failure is to be found in the group of highest intelligence while 50 percent of the failures occurred in the lowest intelligence group. The correlation between the index of brightness and the average marks was found to be 0.47.

Conclusions

We are now in a position to answer the queries raised at the beginning of our discussion. Combining the first and second questions, we are now in a position to state whether or not the results of our research indicate that those pupils who have the highest intelligence make the highest scholastic marks and those of lowest intelligence make the poorest showing scholastically.

The following table gives the simple ratio between the honor pupils in Groups I and V:

Mathematics	4 : 1
History	6.5 : 1
English	9 : 1
Average	24 : 1

The ratio of pupils above the median in the first and the lowest groups are:

Mathematics	2 : 1
English	3 : 1
History	4 : 1
Average Marks	5 : 1

The ratio of failures in Groups I and V are:

Mathematics	1 : 6.5
English	1 : 7.5
History	0 : 68
Average Marks	0 : 50

From these three tables, whether we compare the number of honor pupils, the number above the median, or the number failing, the ratio between the lowest and the highest intelligence groups varies from 2 : 1, in the case of mathematics marks above the median, to 0 : 68, in the case of history failures. Tables I, III, V, and VII further show that, without exception, as one goes from Group I to II and from II to III and so on to Group V, the number of honor pupils and the number of pupils above the median decreases and the number of failures increases.

The third question, the relation of each subject to intelligence, may be answered by tabulating the coefficients of correlation for the various subjects in the order of their numerical values. These are as follows:

Mathematics	$r = +.34$
English	$r = +.35$
History	$r = +.47$
Average Marks	$r = +.47$

In regard to the fourth question raised at the beginning, it may be said that a pupil having a high index of brightness stands four times the chance of being on the mathematics honor roll that the pupil of low index of brightness has, a pupil in history having a high index of brightness has six and one-half times the chance of the pupil of low index of brightness of being on the honor roll, in English the chances are nine to one in favor of the pupil of highest intelligence and the pupil whose index of brightness puts him in Group I has twenty-four times the chance of the pupil in Group V of being in the honor roll of the school, when all the marks are averaged.

Likewise, the pupil having a high index of brightness stands twice as good a chance of being above the median in mathematics as does his fellow pupil of low index of brightness, while he has three times as good a chance in English, four times as good a

chance in history, and five times the chance of having his average above that of the median for the school.

Choosing two youths, one from Group I and the other from Group V, we may conclude that the latter pupil stands more than six times the chance the former does of failing in mathematics and more than seven times the chance of failing in English. He is "infinitely" more likely to fail in history or to have the average of all his marks below the passing mark.

It should be noted, in closing, that when the subjects are arranged according to their rank, first, as to the ratio of pupils in Groups I and V on the honor roll; second, as to the ratio of pupils in Groups I and V above the median; third, as to the ratio of failures in the two groups; and fourth, as to the coefficient of correlation, in each case, mathematics shows the least relation to intelligence, English ranking next to mathematics in three out of four cases, and history showing the closest relation of any subject in three out of four cases. The average marks show the closest relation to intelligence in three cases and is almost tied with history in the fourth.

THE VARIABILITY OF THE ACCOMPLISHMENTS OF PUPILS OF THE SAME MENTAL LEVEL

T. L. Torgerson and Irene Shuman
Department of Educational Measurements, West Allis, Wisconsin

While this brief discussion is concerned with intelligence quotients and mental and educational ages, it does not have for its purpose an evaluation of such measures as proper bases for grade placement and classification. These data have been compiled more specifically for the purpose of throwing further light on the question of the variability of pupil accomplishment when the mental age is the same for the group under consideration.

Dickson[1] in discussing this problem states:

> Let us suppose that two low-first-grade children have the same mental age of approximately six years. If one is a normal child with an I.Q. of 100 or thereabouts, while the other is a dull-over-age child of eight or nine years, with an I.Q. of 70 or 75, the probability is that the younger normal child will do better work than the older mentally retarded pupil, even though the two are of the same mental age. It seems that the alertness of the normal mind more than balances the years of additional experience of the duller child. Whatever the cause, studies made relative to this point lead to the conclusion that, while mental age does indicate similar possibilities of accomplishment, yet the child with the normal intelligence quotient is likely to have some advantage over the child of the same mental age but with a low intelligence quotient.

If this be true, will the child of high intelligence quotient have a similar advantage over the child of the same mental age but with a normal intelligence quotient? The following data were collected from all pupils in the West Allis Schools with a mental age of 12 years (11 years 6 months to 12 years 5 months). The data include a total of 216 pupils. The group intelligence quotients ranged from 72 to 136. Data from the Thorndike-McCall Reading Tests, Form I given June, 1923, were used and in order to determine the accomplishment quotient, a comparison of the mental age and reading age was made. The

[1]Dickson, Virgil E. *Mental Tests and the Classroom Teacher.* Yonkers-on-Hudson, World Book Company, 1923. 231 pp.

accomplishment quotient is the criterion used in this study to determine the variability of accomplishment. Table I sets forth the average accomplishment quotient of each intelligence-quotient group.

These data indicate that the backward pupils, Group II, read as well as the pupils of normal intelligence, Group IV, and that both of these groups read better than the superior pupils, Groups VI and VII. The 36 pupils in Group V, who have intelligence quotients from 106 to 115, represent high average ability, and have the highest accomplishment record.

TABLE I. THE AVERAGE ACCOMPLISHMENT QUOTIENTS OF EACH INTELLIGENCE-QUOTIENT GROUP

Intelligence Quotient	Group	Number of Pupils	Average Reading A. Q.
Below 75	1	1	90
76 to 85	2	43	106
86 to 95	3	44	105
96 to 105	4	67	106
106 to 115	5	36	109
116 to 125	6	15	103
126 Upwards	7	10	100

The opportunities afforded each of the groups for learning were next considered. It is self-evident that the character of the instruction and the amount of practice afforded each group are vital factors to be considered. The grade location of the pupils very largely determines such factors. These data are provided in Table II.

From the data of Table II it is clear that the pupils in the lower grades have high intelligence quotients and low accomplishment quotients, while the pupils in the upper grades have low intelligence quotients and high accomplishment quotients. These data seem to indicate that pupils of low intelligence quotient read better than pupils of high intelligence quotient.

The lockstep system of promotion is responsible for this grade placement. A further analysis of the situation suggests that the reason the accomplishment quotients bear an inverse

ratio to the intelligence quotients is not because this relationship is an inherent one, but rather that it has been produced through the artificial system of the traditional school with its improper grading and classification and its inequality of educational opportunity. A pupil in the fourth grade with sixth-grade ability whose only opportunity is the study of fourth-grade subject-matter cannot hope to raise his educational age to a sixth-grade level unless he is brought in contact with sixth-grade material.

Consequently in order to study the variability of the accomplishment of the pupils of a mental age of 12 years, it is

TABLE II

Grade	Number of Pupils	Intelligence Quotient	Reading A. Q.
III-A	2	120	87.5
IV-B	6	128	94
IV-A	10	113	96.5
V-B	26	115	102.5
V-A	37	110	104
VI-B	20	100	105.5
VI-A	36	97	107
VII-B	30	94	108
VII-A	14	87	115.5
VIII-B	16	83	108
VIII-A	6	82	103
IX-B	13	82	110

essential to consider only the pupils that are graded properly and who have thus been given the same opportunity for maximum accomplishment. In accordance therewith only the pupils with mental ages from 11 years 6 months to 12 years 5 months who were in grades V-A to VII-B, inclusive, were finally considered. This procedure reduced the number of cases to 123. Three intelligence-quotient groups were formed and the average accomplishment quotient computed for each group. These data are set forth in Table III.

From the data of Table III, we see that when the same educational opportunities have been provided among pupils of the same mental age those having the high intelligence quotients read better than those of a lower intelligence quotient. The pupils of Group III have accomplishment quotients 5.7 points higher than

the pupils in Group I. This represents a difference of nine months in the reading age.

It is acknowledged that a pupil's silent-reading ability is no doubt influenced to a considerable extent by his outside reading. A better measure of the variability of accomplishment by pupils of the same mental age would be the accomplishment quotient

TABLE III

Intelligence Quotient	Group	Accomplishment Quotient
Below 95	I	104.4
95 to 105	II	105.8
Above 105	III	110.1

in all the academic subjects or the ratio between educational age and mental age.

In order to secure these data, the results of the Stanford Achievement Test, given December, 1923, for pupils of a mental age of 11 years 6 months were compiled. The Stanford Achievement Test is a very comprehensive test including the following subjects: reading, arithmetic, language, spelling, science, history, and literary information. Age norms are provided for each subject as well as the educational age estimated from the total score. The accomplishment quotients based upon educational age were considered in addition to the accomplishment quotients

TABLE IV

Intelligence Quotient	Group	Reading Accomplishment Quotient	Arithmetic Accomplishment Quotient	Average Accomplishment Quotient
Below 95	I	107.5	112.5	106.8
95 to 105	II	110.1	113.7	109.2
Above 105	III	110.0	107.3	105.9

in reading and arithmetic. As the test had not been given to VII-B pupils it was not deemed advisable to use a mental age of 12. Only the pupils with mental ages between 11 years and 11 years 11 months located in the fifth and sixth grades were considered. A total of 112 cases was secured. These data are set forth in Table IV.

From the data of Table IV we find by comparing Groups I and II that Group II surpasses Group I by 2.6 points in reading, 1.2 in arithmetic, and 2.4 in average accomplishment quotient. This gain of 2.4 points represents a gain of approximately 4 months in educational age. By comparing Groups II and III we find a loss of .1 point in reading, 6.4 in arithmetic, and 3.3 in average accomplishment quotient. Group III surpasses Group I in reading only.

The reading accomplishment quotients of Table IV in general substantiate the results from the Thorndike-McCall Reading Test found in Table III. The Thorndike-McCall accomplishment quotients of Group I and II in Table III are lower than the Stanford accomplishment quotients in Groups I and II of Table IV. This may be accounted for by the fact that during the interval of one semester between the giving of the two tests remedial work with the slower pupils has raised their accomplishment. The reason for lower accomplishment quotients of the superior group in the other subjects as compared with the slow group is not so clear. Undoubtedly the following influences are at work tending to produce the results noted: (1) more remedial work and resulting pressure with the slow group; (2) greater absence of stimuli for the superior pupils to do their best; and (3) the small number of cases in Group III, 19 as compared with 45 in Group I.

While the data of this study are not conclusive, they present considerable evidence to support the contention that the accomplishment of pupils of the same mental age who are given the same opportunity for learning will, in general, vary in direct ratio with the intelligence quotient. The data show further that pupils with high intelligence quotients have low accomplishment quotients, if they are required to work in grades below their mental level. This suggests the importance of proper grading and classification.

Editorials

THE FUTILITY OF ABSTRACT IDEALS

Most of the literature on ideals treats them as abstract nouns. We talk of the importance of honesty; we give inspirational addresses upon the sweetness of charity and the rewards of unselfishness. These talks are often satisfying to the speaker. He feels the fine satisfaction that comes from a good deed well done.

It is tragic to prick this bubble of complacency, yet it is a bubble, for most of the effort is wasted. A new concept may be added to the vocabulary of the student by a talk on abstract ideals, or an old one may be revivified, but conduct is not likely to be affected. The abstract noun is an *abstraction*. It is drawn off from life and drawn so far that the child cannot see the connection between the ideal and his life. To him ideals are merely ideals and things apart from conduct.

Ideals are applied to life when they are treated as adverbs—to modify action. Only when the child is faced with specific situations where he has to act, can ideals be taught. When he finds the purse of an unknown owner on the street, he has to act in some way; and if honesty is to operate it must do so in this situation. The ideal then modifies the instinctive action of keeping the money for himself by leading him to advertise in the Lost and Found Column.

Unless the child is taught the ideal in connection with such specific situations, time is wasted. This is true even when illustrations from the past are used. The story of George Washington and the cherry tree is interesting; but few urban boys at least have cherry trees to cut down and tell the truth about. As a story, such an illustration is good; but as a modifier of conduct it is futile unless it is carried over into the specific situations in the intimate life of the child. It is not a question of what admir-

able things George Washington did, but if what he would do if faced with this situation or that situation in which the child finds himself.

"To put over ideals" it is necessary to collect a huge number of situations which confront the child and to teach the ideal in connection with each situation. Less than this is futile.

We have, for instance, people who are honest in money situation but who are dishonest in respect to statements. Others are quite honest in respect to property, but are less regardful of honesty in preparing assigned lessons. An ideal is like the smallpox. It affects some areas and leaves others free. A man's honesty can be completely gauged only by measuring it in a multitude of specific situations. Abstract honesty is a word; honesty is tied up with actions.

Such a list of situations can be easily prepared. In class assignments to teachers two hundred or more situations involving honesty can be listed. These comprise a dozen or more involving each of the following: finding money, borrowing money, buying, selling, etc. Similar lists of situations can be added which involve honesty in regard to property, to statements, to promises, to rules, to classroom conduct, to tests, and to preparation of assignments.

The topics of a curriculum by which to teach an ideal consist of just such a list of situations which are considered one by one and for each of which the appropriate trait-actions are taught. It does not consist of inspirational addresses and appealing stories which deal with ideals as abstract nouns. Ideals are adverbs.

W. W. C.

Reviews and Abstracts

MOEHLMAN, ARTHUR B. *Child-Accounting.* Detroit, Frieseman Brothers Press, 1924. 205 pp.

This book is an excellent exposition of much good thought in the field of child-accounting. The inspiration for it "came from a long study of conditions in Detroit and in Michigan, starting with a complete reorganization of Detroit records in 1919."

Part I discusses "General Principles," while Part II presents and illustrates a "Method of Child-Accounting." An interesting introductory chapter on the historical aspects traces the development of terminology from the Chicago report of 1862 to the present time. Present needs are analyzed from the standpoint of the needs of the state, of the superintendent, and of the teacher. Chapters on organization, administration, and statistical methods complete the discussion of "General Principles."

Out of Part I, the chapters on "General Organization" and "Administration" will contribute most to the superintendent. The chapter on "General Organizations" orients child-accounting among the functions of the State Department of Education, gives definitions of terms for uniform use, indicates the types of reports needed by the State Department, and suggests the types of state and local organization. The chapter on "Administration" discusses in detail the machinery of handling entries, transfers, withdrawals, and the like, following out the concept of the state system of child-accounting. This chapter is particularly well illustrated.

Part II goes directly to the point of proposing and describing a system of records. The chapter on "School Census" analyses the administrative problems involved in obtaining a good census and indicates the uses of machine tabulation. A chapter on "School Records" similarly discusses the records of promotion, age, progress, and the like, reference being made continually to reproductions of the forms suggested.

Chapters XII and XIII, which make up more than one-fourth of the book, take up the problems of assembling data for local and state administrative uses. Forms are given for bringing out facts useful for administrative purposes. The desirable frequency of such analyses is discussed and a great deal of space is given to presentation of the type of summary, tables, graphs, and so forth that should be used in such reports. These chapters are of outstanding importance.

Perhaps the value of this excellent treatment would be even greater had the author taken a further step. It would seem desirable to show in more detail how these periodic reports which are the florescence of the child-ac-

counting procedure are expected to fructify in affecting policy, attitudes, and the like. Without such continuous functioning in determining policy or attitudes, no adequate system of accounting and reporting will long be supported. Isn't the failure to see this definite functioning one of the reasons for the so generally deplored lack of adequate accounting?

This book is another sign of the growth of the broader viewpoint in school administration. Cities readily become centers of experimentation of far-reaching importance but too often no one takes the trouble to disentangle such experience from the maze of local concomitants. As a result, it fails to affect practice elsewhere to the degree that it deserves. It is, therefore, a cause for rejoicing when those acquainted with such experimentation make their findings available for other cities and for other types of organization. This book makes available a mass of experience that will be of great value to the superintendent of any type of administrative unit.

Teachers College, Columbia University PAUL R. MORT

MACKIE, A., AND COLE, P. R. *Studies in Contemporary Education.* Sydney, N. S. W., Australia, Sydney Teachers College Press, 1924. 153 pp.

Sufficiently often to maintain a continuity of interest we receive from the Sydney Teachers College bulletins and announcements. Now we have a book which although it is quite obviously directed to the attention of educational people in the antipodes also has universal interest. Professor Mackie writes about one-half of the book under the general headings of "Studies in Educational Theory" and "Studies in Experimental Education." Dr. Cole devotes his half of the book to "Studies in Educational Methods" and "Studies in Education Abroad."

To the reviewer the most original part of the book is that which is presented in a chapter entitled "The Elements of Welfare." Of interest, too, is the treatment of "Psycho-Analysis and Education" in which the author (Professor Mackie) takes the position that the teacher should be acquainted with psychoanalytic methods but should not practice them.

Not unnaturally we especially directed our attention to Dr. Cole's treatment of "Education Abroad," because in this case "abroad" sometimes comes close home. The marvels of lavish expenditure on education in the United States are used in an effort to stimulate the people to larger support of schools in New South Wales. The Lincoln School of Teachers College is hit off under the rubric "the last word in schools." The lavishness of its construction and equipment and its prodigal staffing are set forth and again the lesson is brought home to Australia. The possibility is expressed that some day an Australian benefactor may endow an experimental school in connection with the Sydney Teachers College upon a similar if a less extravagant plan. Again in the consideration of the continuation schools of New York City the Australian states are urged to face the question of expense and to establish such schools.

The book is written, as has been indicated, partly in a hortatory spirit. Nevertheless there are extensive portions of it which reveal direct insight into

the function and meaning of education as a social enterprise. Emphatically we ought to know more about what well trained men like Professor Mackie and Dr. Cole are doing in their country. Not to a sufficient degree nor with sufficient frequency do we establish contacts with capable thinkers and workers who are attacking problems similar to our own in other parts of the world.

B. R. BUCKINGHAM

Ohio State University

GRAVES, KATHARINE B. *The Influence of Specialized Training on Tests of General Intelligence.* New York, Teachers College, Columbia University, 1924. 78 pp. (Contributions to Education, No. 143.)

Dr. W. C. Bagley published in the *Journal of the National Education Association* for June, 1923, an article entitled "Do Good Schools Pay?" In this article he showed that there was a coefficient of correlation of approximately .75 between the Ayres school efficiency index of a state and the average score made years later by recruits from that state in the Army Alpha Test. The reviewer has found a correlation of .51 between the median number of months high-school seniors in a community have been in school and the median score of the class on the Mentimeter. One is prepared to believe, therefore, that the amount of educational opportunity a state or community offers its pupils will be reflected in the scores of these pupils on the "group intelligence tests." Dr. Graves has gone still further, however, and has demonstrated that not even the Stanford Revision of the Binet-Simon Scale is free from the effects of training and environment.

Miss Graves in this investigation has given a splendid example of how to conduct scientific experiment. Three groups of pupils were used, both in the preliminary experiment and in the larger investigation: (1) a *control group,* which received no training whatever; (2) a *training group,* which was drilled on questions somewhat similar to those in the Binet list; and (3) a *coached group,* which was instructed and drilled on the material of the Stanford Revision itself. All the pupils were given an initial test, a test immediately following the two weeks of special training, and a test three or four months later to see how much of the training had been lost. About half of the pupils were given a fourth test a year after the training period.

The author found that her control group gained about three months in mental age from the practice effect of having taken the initial test, that her group taking training on material similar to that in the tests gained 6.3 months in average mental-age score, and that her coached group gained more than two years in mental age. A year after the training period, the control group showed about 4.3 months greater score than their initial test would have predicted; the training group showed 4.7 months; and the coached group, 9.1 months.

Perhaps the most important finding of this study is the extent to which taking the test itself improved the scores of the control group, and that this improvement still persisted after a year in which the pupils had no contact whatever with the tests. "Continued testing gives a child an undue advan-

tage over a child who has never had the test before." Miss Graves also suggests that "several alternative forms of the individual examination series are needed, in order to measure intelligence with as little disturbance as possible from coaching, conscious or unconscious."

M. R. TRABUE
Bureau of Educational Research, University of North Carolina

TRABUE, MARION R. *Measuring Results in Education.* New York, American Book Company, 1924. 486 pp.

This volume is another contribution to the rapidly growing list of publications dealing with the technique of measuring schoolroom products and practices. Somewhat more thorough-going and substantial than the previously available ones on the same subject, it strikes a happy balance between the theory of statistics per se and its application to actual schoolroom procedures, particularly in connection with the use of standard tests. It is written in such language and style that classroom teachers will be able to understand it without great difficulty.

The author shows the need for improvement in measuring educational products by citing the gross imperfections of ordinary school marks as has of course also been shown by a number of other authors, but Dr. Trabue's representation of the unreliability of school marks lends emphasis where it is still needed and his illustrations and figures are especially clear.

The treatment of purely statistical principles is limited to the fundamental techniques universally used in the description of distributions. The treatment here of these statistical topics—topics which to be sure are included in practically every book of this description—is novel and refreshing. They are thoroughly illustrated by actual test material and are made more clear than is generally the case.

The rich use of illustrations taken from actual test results and the retelling of the fundamental principles of educational measurement in a language slightly different from that given in similar books already published are probably the chief contributions of this book. It makes no pretense of going into the more complicated technique of higher statistics and not to do this seems to the reviewer altogether proper in a book of this type.

The chapter on the classification of mental tests seems to the reviewer to be particularly good. It attempts to clarify distinctions that are hazy in the minds of many school people. This chapter in particular is a welcome addition to test literature. A chapter each is given to "An Analysis of Some Available Reading Tests from the Point of View of Abilities Measured by Each," and to "How to Study New Tests as They Are Published." A chapter is also given to scales for measuring quality in English composition, in which the author makes comparison of the more important tests and points out some of the statistical difficulties involved. One chapter is devoted to the subject of correlation, illustrations of ordinary correlation tables are given, and the technique for the computation of the Pearson correlation coefficient is explained in its simplest terms.

In the discussion of intelligence tests the author gives a brief history of the Binet-Simon Test and its development into the present-day scales. The distinction is made between individual tests and group tests, and the work of Terman, Herring, Thorndike, and others is briefly mentioned. A brief résumé of the army intelligence tests and the group intelligence tests which have been developed since the war is given. In answer to the question, What intelligence tests should one use? the author suggests that "one's purpose and purse must determine what mental tests should be chosen." It is pointed out that reliability is one of the cardinal virtues to be sought in choosing tests. The author's suggestions on how additional uses can be made of intelligence tests are conservative and sound. The discussion in this book should do much to dispel the vague notions, held by some persons, that intelligence quotients are a sort of a panacea for educational ills. Dr. Trabue points out the great good that can come from the wise use of intelligence tests, but also shows some of the things which these tests cannot do.

An excellent chapter is devoted to the exposition of technical methods of deriving educational scales, and the method of calculating the relative difficulties of the various items of a test is explained in some detail. The method of using the median deviation as the basic unit of scales is shown. This chapter is a welcome contribution as the literature on this topic up to the present time has been somewhat meager.

On the whole the point of view of the author seems to the reviewer to be sound. The book is well written. Old topics are treated in an interesting way; the illustrations are profuse, interesting, and practical; a considerable amount of material in the book is relatively new and original, especially the chapter on classification of mental tests and the last chapter on probable effects of measurements. The book, while containing much technical information, is not too technical for most school people to understand.

JOHN L. STENQUIST

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News Items and Communications

This department will contain news items regarding research workers and their activities. It will also serve as a clearing house for more formal communications on similar topics, preferably of not more than five hundred words. These communications will be printed over the signatures of the authors. Address all correspondence concerning this department to Doctor E. J. Ashbaugh, Ohio State University, Columbus, Ohio.

M. G. Brumbaugh, formerly superintendent of schools in Philadelphia, and later governor of Pennsylvania, is now president of Summerland College, Batesville, South Carolina.

The J. L. Hammett Company, Newark, N. J., announces the publication of the Witham Grammar Tests, Pronouns, for grades VI, VII, and VIII. The tests are of the sentence-completion type.

Marion County, Oregon, of which Salem is the county seat, has been selected as the field of the Far Western Demonstration under the auspices of the Commonwealth Fund Child Health Demonstration Program. Other demonstrations are now under way in North Dakota, Georgia, and Tennessee.

Dr. W. E. Johnson, formerly the president of the Aberdeen Normal School, North Dakota, and last year principal of the high school at the University of Minnesota is now director of education at the California State Teachers College, San Diego.

The Bureau of Vocational Information, 2 West Forty-third Street, New York City, has undertaken the study of wage-earning wives. One hundred such women are being asked to subject their own experiences to objective study.

The Bureau of Educational Research of the University of Illinois has added two recent numbers to its series of bulletins: *Training in the Technique of Study*, by Monroe and Mohlman (No. 20); and *A Survey of the City Schools of Marion, Illinois*, by Monroe (No. 21).

The International Association of Electrotypers is supplying the equipment for the department of electrotyping in the School of Printing, a part of the Baltimore public school system. The equipment will cost about twenty thousand dollars.

The master and journeymen plumbers of Baltimore are acting as sponsors of a course in plumbing in the Carroll Vocational School in that city. The

course will be given in 1925, and more than fifty applicants had registered by the first of November.

Bishop William F. Anderson of the Methodist Episcopal Church, has been elected temporary president of Boston University. He will take office January 1, 1925. President Anderson succeeds ex-President L. H. Murlin who had been previously elected president of DePauw University, Greencastle, Indiana.

Representative City Elementary School Buildings of Illinois is the title of a circular (No. 182), recently issued by the State Superintendent of Public Instruction. The pamphlet contains a large number of photographs of representative buildings together with the law governing the ventilation of the schoolroom.

That North Carolina is genuinely interested in the problem of negro education is shown by the fact that the budget for 1921-25 carried approximately fifteen million dollars for this purpose. The fact that the summer-school attendance in 1924 included 84.5 percent of all the negro teachers in the state is worthy of notice.

The World Federation of Education Associations, which grew out of the World Conference on Education held in Oakland and San Francisco in 1923, will hold its first convention in Edinburgh, Scotland, July 20 to 28, 1925. Information regarding the program can be secured from A. O. Thomas, who is president of the Association, State House, Augusta, Maine; or from C. H. Williams, University of Missouri, Columbia, Missouri.

The Committee on Uniform Child-Accounting and Unit Costs, two members of which, C. D. Dawson and A. B. Moehlman, are also members of the Educational Research Association, has formulated a state system of child-accounting which was adopted by the Michigan State Teachers Association, and is being backed by the State Department of Public Instruction. The record forms are being published by S. A. Courtis, Detroit, Michigan.

The State University of Iowa, through its school of music, has announced the first annual state music contest for the spring of 1925. The contest will consist of four events: solos (voice), male and female; solo (piano); and solo (violin). Provisions are made for district contests, the winners of which will be brought to the State University for the finals.

The World Book Company announces the Cross English Test, in two forms for high schools and colleges, by Professor E. A. Cross of the State Teachers College, Greeley, Colorado. The test consists of eight parts as follows: spelling, pronounciation, recognition of sentences, punctuation, verb forms, pronoun forms, idiomatic expressions, and miscellaneous faulty expressions.

Industrial Education in the Public Schools of Minnesota is the title of a recent educational monograph (No. 6) of the College of Education, University of Minnesota. The study, made by Homer J. Smith of the Department of Trade and Industrial Education, gives a detailed report of the history and present practice of industrial education, and makes suggestions for future development.

The *Vocational Guidance Magazine* for October, 1924, is devoted entirely to the work of vocational guidance in the Boston public schools. The work of vocational counselors in connection with the regular schools, trade schools, etc., placement, follow-up work, readjustment, and educational guidance are all included in the articles presented. The issue should be of exceptional interest to school administrators who are seriously considering definite work in vocational guidance.

New York City is using the radio for the education of large numbers of the citizens with respect to the ideals, purposes, and costs of the public schools. They have recently published the addresses given over radio between February 18 and May 19, 1924. Those interested will find the addresses given in complete form in a bulletin recently issued by the Board of Education.

Health Education: Program for Public Schools and Teacher-Training Institutions is a bulletin of 161 pages, prepared by a joint committee of the National Education Association and the American Medical Association, under the chairmanship of Dr. Thomas D. Wood. The subject-matter essential to the teacher, the educational problems, and the suggestions for courses of study, comprise the major portion of the bulletin. A large number of results supplement the other material.

The *Phi Delta Kappan*, the national journal of the honorary educational fraternity, for October, 1924, contains a list of suggestions for needed research from men in colleges of education, superintendents of schools, principals, and teachers. College teachers directing the research work of students will find many suggestions among the problems herein listed.

School boards are using photographs and graphic representations to make clear to their public the educational needs of the communities. The pamphlet entitled, "How Lincoln Pupils Are Housed: A School-Building Program," by the Board of Education, Lincoln, Nebraska, is illustrative of this increased emphasis on the matter. It was used effectively in the last election.

"Health Through the School Day," (Education Bulletin, No. 5) published by the National Catholic Welfare Conference, Bureau of Education, Washington, D. C., presents eighty pages of usable material and helpful suggestions for teaching health. Age, characteristics, and interests, minimum essentials in health information, health stories, and the correlation of subject-matter and method are especially well discussed.

The State University of Iowa publishes each semester the average point grades for each of the colleges and each of the college fraternities and sororities. For the second semester, 1923-24, the College of Dentistry leads, with Law second, and Liberal Arts third. The highest average was made by all sorority women, and the lowest by non-fraternity men.

At the beginning of the current school year president H. A. Brown of the State Normal School at Oshkosh, Wisconsin, announced a new department for the education of exceptional children. Dr. William L. Dealey has been appointed head of the new department. The first effort of the department will be to create proper curricula for the training of teachers of subnormal children, which will later be extended to include preparation of teachers for other types of exceptional pupils.

Laidlaw Brothers, Chicago and New York, have published a set of work, drill, and test sheets in arithmetic, by N. G. Lennes, co-author of *Lennes and Jenkins Applied Arithmetic*, and *Slaught and Lennes Algebra and Geometry*. The sheets come in separate packages for grades II to VIII, inclusive; and are arranged for both drill and testing as indicated in the title. The work for grade II includes 128 sheets, and for each of the other grades, 96 sheets. The material is put up in envelopes according to requirements of individual schools varying by five's from 20 to 50 sheets of a kind.

Dr. Stephen G. Rich reports the following correlation between certain intelligence tests on the basis of eleven students in Howard College, Birmingham, Alabama, in the summer of 1924: The Illinois and Otis Classification, .51 ± .17; the Illinois and Terman, .33 ± .20; the Terman and Otis, .72 ± .12. The giving of mental tests to the students in small classes is worth while from the standpoint of acquainting the students with test form and technique; but correlations with such numbers are of little or no value.

The Bureau of Vocational Information (New York City) has prepared a volume on *Training for the Professions and Allied Occupations*. The volume attempts to give a brief summary of occupations considered in each field which effect the choice of training course, the various kinds of training in each field, and a list of schools in each field, with a statement of admission, requirements, courses, costs, etc. This volume could be of distinct service to workers in educational guidance in high schools and colleges.

A course in junior business training is being given this year in the junior high school of Baltimore. The first part of the course gives general business information, such as: saving, investment principles, commercial bank, carrying money safely, shipping of packages, use of telephone, filing, securing a job, local transportation, business forms, business ethics, simple parliamentary law, use of the postal service, sources of information, record blanks, budget making, etc. The second part is more definitely vocational training, including such

topics as: messenger service, mail-clerk, file-clerk, shipping-clerk, billing-clerk, stockroom-clerk, cashier, etc.

Mr. G. G. Brinkley of the George Washington High School, New York City, has been conducting a study of the use of "new type" tests, consisting of true-false, completion, and multiple-choice in history. As reported in the *New York Sun* he finds that more than 80 percent of the pupils prefer either all new type tests or tests made up partly of new type. He reports that a large majority of the students have studied more thoroughly and regularly because of these weekly tests, and that they are objected to chiefly by the poorer class of students.

Dr. C. C. McCracken of the Department of School Administration, Ohio State University, has been cooperating with the secretary of the Board of Education of the United Presbyterian Church in a survey of higher institutions of learning of that denomination. A survey of the curriculum and administration of Monmouth College, Monmouth, Illinois, was made in 1922; of Sterling College, Sterling, Kansas; of Tarkio College, Tarkio, Missouri; and of Muskingum College, New Concord, Ohio, in 1924. He has also been requested to make a similar survey of Westminster College, New Wilmington, Pennsylvania, and prepare a unit report on higher education for the General Board.

The October, 1924, issue of *Teaching*, the journal of the Kansas State Teachers College at Emporia, is devoted to the 1924 Kansas State Scholarship Contest. This contest has created a great deal of interest throughout the state; it has been the inspiration of similar contests in other states; and has focused the attention of the faculty of the teachers college where the contest is held upon remedial instruction in a convincing way. The various departments of the college analyzed the results of the examinations in the contest last May, and have summarized the findings in this issue of the journal. The Third Annual Contest will be held May 2, 1925, with Professor E. R. Wood acting director.

Test or Tests in Prognosis

A well-attested fact of statistical procedure is that, whenever possible, two or more samples should be taken of any trait to be measured. The organization of mental traits is so complicated and the factors determining the products so variable that by taking two or more samples the factors which influence performance may be more effectively controlled. The child in the first performance may have failed to understand the instructions, may have been angry, or may have failed to become sensitive to the seriousness of the occasion and made play of it. In a second performance he may have obtained an understanding of the procedure and be more willing to try. The problem, both practical and theoretical growing out of this thought is, to determine to what extent will the repetition of the test or the giving of another similar test or tests influence the prognosis?

The question to be investigated is to what extent does the giving of more than one intelligence test influence the prognosis of school marks. The correlation of four intelligence tests with marks has been reported in another connection.[1] Now how much larger is the correlation coefficient when two tests are used, or when three tests are used, or even four tests are used?

Table I sets forth the correlations of these tests with total marks, with English, with mathematics, and with general science for 67 high-school students. The correlation coefficient for all marks combined is approximately 0.45, while for English it is approximately 0.40, mathematics, approximately 0.33; and general science, approximately 0.45.

TABLE I. CORRELATION OF INTELLIGENCE TESTS WITH SCHOOL MARKS

	Total Marks	English	Mathematics	General Science
Otis	.450	.410	.281	.407
Miller	.476	.428	.342	.466
Alpha	.476	.391	.371	.480
Terman	.492	.424	.335	.508

There are at least two ways in which prophecy may be made from the combination of any two tests. The proper weights may be obtained from the ordinary regression equation with three variables

$$x_1 = b_{12.3}\, x_2 + b_{13.2}\, x_3$$

with these in hand multiply the scores in the two intelligence tests by the proper weights, and then correlate the sum of these weighted scores with the criterion. This gives the maximum correlation. Such procedures involve a tremendous amount of work. Fortunately there has been developed a formula by which the prophecy may be obtained without the weariness of the aforementioned procedure. This formula as given by Yule[2] is

$$1 - R^2_{1(23\ldots n)} = (1 - r^2_{12})\,(1 - r^2_{13.2})\,(1 - r^2_{14.23})\ldots(1 - r^2_{1n.23\ldots(n-1)})$$

becomes with two tests and the criterion

$$R_{1.23} = \sqrt{1 - (1 - r^2_{12})\,(1 - r^2_{13.2})}$$

This gives us the maximum correlation obtainable when the tests are weighted and combined in the best possible manner.[3]

From Table II it is evident that a combination of either Terman and Miller or of Alpha and Otis give the highest correlation with total marks. Practically one would choose the Terman and Miller tests, since they require so much less time to give than the other two. Otis and Miller seem to be the poorest combination for their correlation with school marks is the lowest.

[1] Jordan, A. M. "The Correlation of Four Intelligence Tests with Grades." *Journal of Educational Psychology*, 13:419-29, October, 1922.

[2] Yule, G. U. *Introduction to the Theory of Statistics*. London, Charles Griffin Company, 1919. p. 248.

[3] For an interesting use of this coefficient see Hull, Clark L. "Prediction Formulae for Terms of Aptitude Tests." *Journal of Applied Psychology*, September, 1923.

From Tables I and II, it appears that for purposes of classifying pupils into slowly moving and rapidly moving sections the combination of two tests is better, but not much better than one test taken alone. Similar results obtain when English is considered alone for there is but a slightly higher correlation

TABLE II. THE MAXIMUM CORRELATIONS WITH SCHOOL MARKS WHEN TWO TESTS ARE USED

	Test Combinations	Total Marks	English	Mathematics	General Science
$R_{1.23}$	Otis and Miller	.447	.469	.344	.480
$R_{1.24}$	Terman and Alpha	.519	.405	.381	.530
$R_{1.25}$	Terman and Otis	.502	.441	.333	.509
$R_{1.35}$	Terman and Miller	.520	.462	.358	.527
$R_{1.42}$	Alpha and Otis	.520	.424	.369	.481
$R_{1.43}$	Alpha and Miller	.510	.442	.385	.508

Note: 1 is Total Marks; 2, Otis; 3, Miller; 4, Alpha; and 5, Terman.

obtainable from two tests than from one. Moreover, what has been said of total marks and English holds true also of mathematics and general science for with them also two tests give only a slightly larger correlation than does one test.

When three tests are used some of the combinations, Otis, Miller, and Alpha for example, do not give as large a coefficient as Terman and Otis, or Alpha and Otis. All of them, however, are higher than the highest when the

TABLE III. THE MAXIMUM CORRELATIONS WITH SCHOOL MARKS WHEN THREE INTELLIGENCE TESTS ARE COMBINED IN THE BEST POSSIBLE MANNER

	Test Combinations	Total Marks	English	Mathematics	General Science
$R_{1.234}$	Otis, Miller, Alpha	.505	.455	.390	.514
$R_{1.235}$	Otis, Miller, Terman	.514	.458	.367	.536
$R_{1.345}$	Miller, Alpha, Terman	.534	.460	.390	.539
$R_{1.245}$	Otis, Alpha, Terman	.515	.448	.322	.532

Note: 1 is Total Number; 2, Otis; 3, Miller; 4, Alpha; and 5, Terman.

single tests are used. Although no three tests in the case of English correlate as highly with grades as do Otis and Miller combined or Terman and Miller combined, still they are all higher than any test used singly. Of the cases thus far examined Miller, Alpha, and Terman give the best correlation with marks in mathematics. The same combination also gives the highest correlation with general science yet obtained for it is higher than any correlation obtained on any combination of two tests or of one considered alone.

In total grades all four tests combined give no better results than these reached with a combination of two tests. The highest correlation with mathematics and with general science is obtained with all tests combined. The

differences between the use of four tests and two or three tests, however, are very small indeed.

TABLE IV. THE MAXIMUM CORRELATION WITH SCHOOL MARKS WHEN ALL FOUR INTELLIGENCE TESTS ARE USED

	Total Marks	English	Mathematics	General Science
$R_{1.2345}$	.522	.463	.401	.550

Note: 1 is Total Marks; 2, Otis; 3, Miller; 4, Alpha; 5, Terman.

SUMMARY

1. There is only slight gain effected in prognosis by using two tests rather than one.

2. Three or four intelligence tests do not seem to give any better prophecy than two.

3. For classifying pupils at the beginning of the course in English the Otis and Miller tests seem the best combination of the tests here discovered; for mathematics, Alpha and Miller; for general science, Terman and Otis or Miller and Alpha; and for total marks, Alpha and Otis or Terman and Miller.

The results of this study seem to indicate that little improvement in classification is obtained by giving several intelligence tests. The practical plan of giving a second test only to those who fall very low in the first one, seems to be the better procedure.

A. M. JORDAN

University of North Carolina

An Experiment in the Improvement of Rate and Comprehension in Silent Reading

The purpose of this experiment was to determine the effect of a period of practice in rapid silent reading with emphasis on thought getting. The experiment was carried out with six fourth grades, four fifth grades, and three seventh grades, a total of 428 children, and was continued for four weeks. Thirty minutes of the regular reading study period was allotted to the work, during which four or five minutes were given to specific drill in rapid silent reading. This reading was broken into half-minute and full-minute intervals, and each interval was followed by a few minutes of rapid questioning by the teacher on the subject-matter just read. Previously prepared lists of questions, made out by the different teachers and mimeographed for the purpose, facilitated this questioning. The questions were numerous but specific with answers given. Each teacher was allowed to develop her own method of asking the questions or adopting the questions to her own class, but in all cases emphasis was placed on rapid reading and rapid-fire questions on the material read.

Lessons which had not already been read by the pupils were selected from the regular text. For some one minute during the reading period the number

of words read was recorded by each pupil on an individual graph sheet. The pupils were taught how to record each day's score and to construct the graph, the significance of the resulting curve being at once apparent to the pupil. Thus the record became a further incentive toward rapid reading.

On the day before the experiment was begun the Monroe Standardized Silent Reading Test, Revised, was given to all the pupils and to five control groups; who were given the usual instruction in reading during the period of the experiment. About half the classes were given Form II of the test and the other half, Form III. At the end of the four weeks the Monroe

TABLE I. SCORES ON THE MONROE SILENT READING TEST FOR THE GROUP GIVEN TRAINING IN RAPID SILENT READING

Class	Number of Pupils	Jan. 4 Scores before Practice		Feb. 4 Scores after Practice		Percent Gain	
		Comprehension	Rate	Comprehension	Rate	Comprehension	Rate
Grade IV							
A	40	3	42	8	140	167	233
B	37	8	120	10	152	25	27
C	35	7	94	12	170	71	81
D	40	5	74	10	150	100	103
E	29	6	92	7	140	17	52
F	12	5	87	6.5	105	30	21
Total	193						
Weighted Average		5.68	83.4	9.31	147.6	63.7	77
Grade V							
G	38	7	110	12	197	71	79
H	15	8	106	11	148	38	40
I	37	8	109	11	173	38	59
J	35	9	117	11	170	22	45
Total	125						
Weighted Average		7.0	111.1	11.3	176.3	61	59
Grade VII							
K	44	13.5	177	13.2	200	−3	13
L	33	11.7	171	13	195	11	14
M	33	13.7	186	15	224	10	20
Total	110						
Weighted Average		13.0	178	13.7	205.9	5.4	16
Scores of Control Group							
Grade III	12	4	84	4	81	0	−4
Grade IV	33	6	94	7	92	17	−2
Grade V	37	7	83	7	92	0	11
Grade VI	31	9	145	11	164	22	13
Grade VI	31	95	140	10	154	5	10

Reading Test was given again. Those classes that had taken Form II at the beginning of the experiment were given Form III at the end while those taking Form III at the beginning were given Form II. The scores before and after the four weeks' training are given in Table I. The results are also presented in graphic form.

The results of this experiment, as shown by the table, are almost startling. Three hundred and eighteen pupils in the fourth and fifth grades increased both their comprehension and rate more than fifty percent as the result of one month's practice with only the usual amount of time spent on reading. These pupils raised their average from decidedly below normal to substantially above normal in this time. Improvement was shown by the daily records of the pupils as well as in the two standard tests. Some teachers kept daily scores on questions answered and averages for reading rate. These records showed the same general progress as the results of the two standard tests indicated. It is interesting to note that there is generally about the same percent of gain in both comprehension and in rate.

The seventh-grade pupils also increased their rate, but not so much as the others. This is to be accounted for partly by the fact that two of the three teachers of these pupils had already been using a modified form of the method of the experiment before the experiment was started. These pupils had already reached or exceeded the norms for their grades despite the fact that they were both classes of slow pupils.

Even some of the control groups made considerable gain. This appeared unexplainable until pupils of the control groups explained that they had heard of the experiment and said they had determined to improve their reading so as not to be outdone by those taking the experiment.

This experiment illustrates the rapid gain that comes from specific teaching under definite incentives and purposes. Three things seem to have contributed to the rapid gain of these pupils in silent reading: (1) The use of direct and definite methods of teaching with the specific objective of efficient rapid silent reading. (2) Knowledge of attainment by pupils and teachers through measurement of results. The pupils and teachers were really able to see gain from day to day. (3) Incentive to effort through the use of the methods already described and especially through the use of graphic records.

The methods of this experiment may be used by any teacher without the use of much additional time or energy. The questions should be prepared beforehand and this does take some time. The teachers who conducted this experiment were divided into small groups for constructing the questions. This sort of practice could well take the place of an occasional dull teachers' meeting, and once a list of questions was prepared they could be used over and over again. Some publishers might even be induced to have elaborate sets of questions prepared for their readers.

A. R. GILLILAND

Lafayette College

On the Relative Merits of Subtraction Methods: Another View

In a recent issue of this Journal,[1] the old question of the relative merits of the various methods of teaching subtraction was treated at some length, both historically and in the light of some new data. In spite of the sincerity with which this study was carried out, the present writers find themselves unable to agree with certain conclusions reached from the statistical analysis of the findings presented.

The present paper holds no brief for any particular method of subtraction, unless the position taken that the old "take-away" or "decomposition" method should not be abandoned in favor of additive methods until further evidence is at hand can fairly be said to be partisan. There are, however, arguments for the older method which can be stated.

The results of the paper just cited are open to a variety of statistical criticisms which collectively render the conclusions drawn highly problematical. These objections are:

1. Of the five distributions presented only one (the first) is based upon a sampling large enough to establish any conclusions. Since the first distribution (the decomposition method) is to be compared with each of the other four, there are no pairs of samplings large enough to establish statistically significant differences in the methods, unless relatively great differences were found. This was not the case as is seen from our Table I below. The differences are at all times very slight.

2. The set of examples used for the experiments was far too easy with the result that more than 35 percent of the total group received perfect scores. This has two serious consequences: (1) more than one-third of the group were, therefore, not measured at all, and (2) the resulting distributions were skewed so badly as to make any statistical treatment very uncertain.

3. The differences presented were found to be considerably lessened upon recalculation of the data due to an error in the original computation. (See Table I below.)

4. Since 80 percent of the subjects (220 of the 277) had learned the decomposition method, it might well happen that the four small—and numerically atypical—groups have undergone systematic selective tendencies in their previous instruction. Minority methods are often superior methods because the more original and progressive teachers are likely to be attracted to new methods. Should this have been the case, the minority groups might well have had, by and large, somewhat superior instruction. One of the writers has run into just such a situation before in dealing with another school subject.

The first three of these objections, at any rate, can be established and must be weighed in accepting the evidence at face value. Table I will throw some light on our questions.

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[1] Johnson, J. T. *The Merits of Different Methods of Subtraction*, 10. 279-90, November, 1924.

TABLE I. A SUMMARY OF TABLE I OF JOHNSON'S STUDY GIVING THE MEAN ACCURACY SCORES EARNED ON THE COURTIS SUBTRACTION CARD NO. 33 BY THE GROUPS USING THE SEVERAL METHODS OF SUBTRACTION

SCORE	METHOD				
	I	II	III	IV	Mixed
	f	f	f	f	f
17	75	13	2	8	3
16	74	5	4	3	6
15	35	2	1	1[a]	1
14	22	3	0	1	2
13	5		1		0
12	6				0
11	1				1
10	1				
9	1				
N	220	23	8	13	13
M	15.7[b]	16.2	15.75	16.4	15.5
S.D.	1.4	1.1	1.2	0.9	1.6
P.E.	0.9	0.7	0.8	0.6	1.1

[a] Printed as 5 but here taken as 15, since the use of the latter value checks with the mean reported.
[b] The original mean score was given as 15.3, which is an error.

The methods referred to in the table are:
I. Decomposition: take-away-borrowing,
II. Equal additions: take-away-carrying,
III. Addition-borrowing: sometimes called Austrian (but not by Johnson),
IV. Addition-carrying: called Austrian by Johnson.
V. Mixed and "freak" methods.

When the error has been corrected, the largest difference remaining proves to be 0.7 of an example between methods I and IV. This is surely a small basis of fact upon which to decide an important issue; especially when one mean is based upon 13 cases. *The only conclusion which can follow, statistically, is that no genuine differences were found.*

Mr. Johnson has gone a considerable step forward in defining our concepts of the various subtraction methods and we are in hearty agreement with his timely suggestion that recourse should be had at once to actual experimentation. The handful of experiments thus far reported, with one or two exceptions, are far from conclusive evidence due to their lack of adequate controls and long-time continuance. It happens that the one experiment with the most rigorous controls (Mead and Sears) turned out to favor take-away methods. The writers hope to proceed to carefully controlled experiments in the near future.

G. M. RUCH
F. B. KNIGHT
O. S. LUTES

University of Iowa

Educational Research Association

E. J. ASHBAUGH, *President*,
HARRY A. GREENE, *Secretary*

Program for the Meeting of the Educational Research Association at Cincinnati

The Educational Research Association at the time of its annual meeting in Cincinnati plans to present two programs which will be open to the general public. The first open meeting is to be held Tuesday afternoon, February 24, at 2:15 o'clock. The second is scheduled for Wednesday afternoon, February 25. The Tuesday afternoon meeting centers about the consideration of administrative problems, while the Wednesday afternoon meeting deals fundamentally with problems of supervision.

The meetings of the Association for members only will be announced to the membership by the President as soon as the assignments of place and time are available from the Secretary of the N. E. A.

TUESDAY AFTERNOON, FEBRUARY 24, 2:15 O'CLOCK

ADMINISTRATION

Sectioning Junior High-School Pupils by Tests and School Marks. FOWLER D. BROOKS, *Johns Hopkins University, Baltimore, Maryland.*

Class-Size and Teaching Efficiency. P. R. STEVENSON, *Bureau of Educational Research, Ohio State University, Columbus.*

Organization of the Supervisory Department. FRED C. AYER, *University of Washington, Seattle, Washington.*

Effectiveness of Half-Time Sessions. P. T. RANKIN, *Bureau of Educational Research, Board of Education, Detroit, Michigan.*

Results in a Child-Guidance Clinic. M. E. HAGGERTY, *University of Minnesota, Minneapolis, Minnesota.*

WEDNESDAY AFTERNOON, FEBRUARY 25, 2:15 O'CLOCK

SUPERVISION

Specific Objectives in Junior High-School Mathematics. RALEIGH SCHORLING, *Principal, University Schools, University of Michigan, Ann Arbor, Michigan.*

Names and Dates in American History as Found in Eighth-Grade Children's Minds. F. D. CRAM, *Iowa State Teachers College, Cedar Falls, Iowa.*

Highest Frequency Questions in Geography Examinations. W. J. OSBURN, *State Department of Public Instruction, Madison, Wisconsin.*

A Scientifically Graded Book List for Children. C. W. WASHBURNE, *Superintendent of Schools, Winnetka, Illinois.*

Status of Scientific Inquiry concerning the Relation between Rate and Comprehension in Reading. W. S. GRAY, *University of Chicago, Chicago, Illinois.*